Qualitative Perspectives on the Strange Trails of Persistence in STEM

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ABSTRACT

QUALITATIVE PERSPECTIVES ON THE STRANGE TRAILS OF PERSISTENCE IN STEM

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Northern Illinois University, 2020
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In 2019, a midwestern state university was awarded a $1 million NSF S-STEM grant to support scholarships for academically gifted, Pell Grant-eligible undergraduates enrolled in one of six designated STEM majors. Educational research was also funded by this grant, with the goal of identifying and contextualizing supports and challenges that impact persistence in STEM within the setting of a near-peer-mentored social support group during the fall of 2019. The purpose of this group was to provide social support and foster a sense of belonging for the twelve scholars. Such support is important for guiding students towards personal development and degree completion. This is of great significance given that persistence in STEM is widely identified as low and therefore problematic for the growing demand for new scientists. This complex and systemic issue warrants a deeper understanding to contextualize substantial statistical data. In this qualitative thesis, I have taken a case study methodological approach to share the lived experiences of twelve STEM undergraduates during the Fall 2019 semester as they participated in a peer group led by myself. Results from this study highlight the importance of social/emotional support as well as specific struggles faced by STEM students. Among the most prominent themes was the significance of normalizing these struggles, thereby helping the students feel less alone and a stronger sense of their identities in science.
QUALITATIVE PERSPECTIVES ON THE STRANGE TRAILS OF PERSISTENCE IN STEM

BY

ERIKA ZOCHER
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A THESIS SUBMITTED TO THE GRADUATE SCHOOL IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE

MASTER OF SCIENCE
DEPARTMENT OF GEOLOGY AND ENVIRONMENTAL GEOSCIENCES

Thesis Director:
Nicole LaDue
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Lastly, none of this could have happened without the participation, trust, and openness of the BELONG in STEM scholars. I thank each of the twelve members of the group for contributing in our efforts to better understand persistence in STEM, but more importantly for all they have done to help build a truly special community.
DEDICATION

To the BELONG in STEM scholars:

Keep following the strange trails.

And remember, you’ll always have Chad and me in your corner.
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CHAPTER 1. INTRODUCTION

“I would like to have a friend that’s also [like me]. Because a lot of people, they're always like, ‘Oh, that's so great.’ But I can't even put into words how stressful it is. So it'd be nice to feel like I have a shoulder to lean on… It would be nice to have someone who could relate.” –Helen, STEM major

It can hardly be denied: making it through college is not an easy endeavor. In the ever-competitive and changing career climate of today’s world, college students may face any variety of mountainous forces acting upon them. Much statistical evidence indicates that many STEM majors in particular struggle to make it through; according to a 2012 presidential report tracking 17,000 US college students, nearly 60% of STEM majors switched to a non-STEM field (31%) or dropped out (29%) (President's Council of Advisors on Science and Technology, 2012). Reasons for this disparity have been suggested as relating to a lack of interest in STEM, an off-putting culture in STEM, and returns that are insufficiently high to justify the means of being a STEM major (Bettinger, 2010). Furthermore, this is an issue that disproportionally affects certain populations of students. Studies have often determined that women, under-represented minorities, first-generation students, and low-income students leave STEM at higher rates compared to their counterparts (Anderson & Kim, 2006; Griffith, 2010). For instance, data from a national six-year longitudinal study tracking 12,000 students from 1995 to 2001 highlighted disparities such as the parental education and income of “completers” versus “non-completers”; 64% of completers had at least one parent with a bachelor’s degree and 47% of completers came from families in the highest third of the national income level (Anderson & Kim, 2006).
Griffith (2010) summarized longitudinal data regarding gender differences in STEM, showing that women were less likely to enter STEM fields compared with men (13% versus 34%) and of those, less women achieved their degree than men (37% versus 43%) (Griffith, 2010). These data indicate systemic issues in higher education in which certain students are facing more barriers than others. In an effort to address this significant problem, the National Science Foundation has established a program to provide institutions with scholarships for low-income, academically talented students in science disciplines, titled the “Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM) Program”. The goals of this program are to increase the number of such students, improve their educational experiences in STEM, and to generate knowledge about how to further such efforts for future students. A Midwestern university was the recipient of an S-STEM grant in 2019, with five years of funding for low-income, high academic achieving students and community college transfers. As part of this program, students were involved in a weekly peer group to provide social support. This study describes the experiences of the initial cohort of the scholarship recipients in the peer group over the course of the fall 2019 semester, and also highlights supports and challenges that have impacted the students’ abilities to persist leading up to the program. For example, the opening quote was taken from an intake interview with Helen, a junior who had just transferred to the current university. During the meeting, she expressed feeling different than those around her at school and the desire for someone who can relate. She articulated this as a significant challenge to her academic and personal life. The isolating experiences that Helen described are ironically akin to feelings described by many college students— as they go through their education, they want to be heard and understood; they don’t want to be alone in their identities and experiences (Zaniewski &
Reinholz, 2016). Moreover, they want to belong. In the following sections, further explanation of the scholarship program and the present study will be discussed.

*The BELONG in STEM Scholarship Program*

In 2018, a Midwestern state university was awarded a $1 million, Track-2 NSF S-STEM grant (# 1834076) to support scholarships for academically gifted students with demonstrated high financial need enrolled in one of six designated STEM majors (mathematics, chemistry/biochemistry, physics, computer science, biological sciences, geology and environmental geosciences), titled the BELONG (Building Engagement in Laboratories, Networking, and Peer Groups) in STEM Scholarship Program. The current research study was also funded, in part, by this grant, with the goal of identifying and contextualizing the supports and challenges that impact persistence in STEM within the setting of a near-peer-mentored social support group consisting of the twelve scholarship recipients: the BELONG in STEM scholars. The purpose of this group was to provide social support and develop a sense of belonging for the scholars as they work through their degree programs, opening a space for students to connect and relate to one another. Such support is commonly lacking in structure or awareness in STEM programs, yet it is critical for enhancing the student experience and guiding undergraduates toward development and degree completion (Crisp & Cruz, 2009; Holland et al., 2012). Given the general ambiguity of identity and advancement towards adulthood during college years (Baxter Magolda, 2004), this group also served to provide context for students to explore their social and emotional needs during these uncertain and dynamic times. In this setting, I as the group leader sought to facilitate a unique and productive experience for students to connect in ways that otherwise might not arise in normal college life.
**Present Study**

In the following qualitative study, I have taken a case study methodological approach to describing the supports, challenges, and experiences of STEM undergraduates in an NSF-funded scholarship program aimed to promote persistence in STEM. The case study methodology is ideal for examining these phenomena because it allows for narratives to emerge, thereby contextualizing existing statistics regarding low persistence in STEM. This is imperative for understanding and improving this critical issue. Multiple data sources, including individual interviews, researcher reflections, and a focus group interview, were triangulated to understand the experiences of the student participants in the support group.

This study addresses the following research questions:

1. **What sources of support do students commonly reference prior to the program?**
2. **What challenges do students commonly reference prior to the program?**
3. **How do students describe their experiences in the group as a support or challenge?**
4. **What do participants describe as significant impacts from the group?**

**Operational Definitions**

“Prior to the program” refers to any experiences leading up to the fall 2019 semester. For this study, “supports” were defined as internal (e.g., self-regulatory) or external resources or experiences (e.g., relationships) that participants described as emotionally/psychologically helpful and/or as having had a positive impact on their academic and/or personal development.

“Challenges” were defined as internal or external resources or experiences that participants described as emotionally/psychologically unhelpful and/or as having had a negative impact on their academic and/or personal development. “Significant impacts from the group” are defined as
overall common themes of support that were most salient from the focus group interview and include impacts that affected the students outside of the group itself.

Addressing Gaps in Literature

This qualitative approach adds context to the robust quantitative-based literature about persistence by detailing the experiences of a group of academically successful STEM students in the shared experience of a peer group. Guiding this work, theoretical frameworks such as Theory of Student Departure (Tinto, 1975) and Theory of Self-Authorship (Baxter Magolda, 2004) were applied to formulate program design and guide methods of this study, to understand students’ experiences in the peer group and the factors that impact their abilities to persist in their degrees.

The main gap in the literature that this study addresses is the fact that many previous studies on persistence in STEM have employed quantitative techniques, involving large national survey-based datasets. Although such studies provide necessary statistical patterns that bring to light the issue of low undergraduate STEM persistence, they lack the robust narratives and contextual understanding that can be achieved via qualitative research. Therefore, by tapping into students’ lived experiences as they persist in their education, it is possible to gain deeper insights into the important challenges and supports that surround and influence them.
CHAPTER 2. LITERATURE REVIEW

Persistence in STEM: Who Is Leaving College and Why?

It is well established that undergraduates in science, technology, engineering, and math (STEM) programs tend to have lower rates of retention in college compared to other majors across U.S. institutions (Crisp & Cruz, 2009; Holland et al., 2012). According to a national 2012 study, more than half of students entering STEM had switched majors (31%) or dropped out of college altogether (29%; President’s Council of Advisors on Science and Technology, 2012). Underrepresented groups such as women, minorities, and low-income students are shown to be most affected by this phenomenon (Anderson & Kim, 2006; Griffith, 2010). Such students are less likely to pick a STEM major in the first place, and those who do are less likely to stay in that major (Chen & Thomas, 2009). This has warranted numerous studies to investigate contributing factors to this gap and how to tackle those challenges (Chen & Thomas, 2009; Griffith, 2010). Griffith (2010) examined how institutional characteristics such as the gender and racial makeup of STEM departments’ faculty, undergraduates, and graduate students as well as the research and undergraduate teaching focus affect female and minority students’ decision to persist in a STEM major. Student experiences in college and within individual departments, as well as the educational focus of the institution, all had major impacts on the likelihood of a student remaining in a STEM major. Griffith suggests that students attending institutions with a focus on undergraduate teaching and research are more likely to persist, compared with institutions more heavily focused on graduate-level research (Griffith, 2010).
The study also presented evidence that role models can play a significant role in a students’ choice of college major. More specifically, as female and minority graduate student populations rise, so do the undergraduate populations of these groups (Griffith, 2010). Griffith emphasizes the way that students initially “sort” into different departments and institutions as a potential driving force behind the underrepresentation of women and minorities in STEM and calls for further research into examining these “sorting patterns” (Griffith, 2010, p. 921).

In the following sections, a review of literature related to science identity, self-efficacy, and sense of belonging in STEM will be highlighted. These three particular themes are emphasized for their interdisciplinary and broadly relevant contexts, as well as their importance to student and young adult development in general.

**Sense of Belonging, Self-Efficacy, and Science Identity**

Student success and retention in STEM involve many factors, including psychosocial themes of sense of belonging, self-efficacy, and science identity. In Maslow’s hierarchy of human needs, sense of belonging is identified as an essential human need and a prerequisite for achieving a sense of self-worth (Maslow, 1970). Sense of belonging is cited as a key factor for student success and is often lacking for underrepresented students in science (Zaniewski & Reinholz, 2016). A lack of similar peers and role models, as well as negative stereotypes, contributes to these students not feeling that they belong in the given discipline (Zaniewski & Reinholz, 2016).

Science identity is described as a combination of a student’s personal identity, social identity, and identity within his or her chosen field (Potvin & Hazari, 2013). It has been widely documented that having a science identity plays a highly important role in student involvement, persistence, and career selection (Carlone & Johnson, 2007; Chang et al., 2011; Foor & Walden,
Potvin and Hazari (2013) studied science identity in physics undergraduates and found that performance and competence beliefs are not sufficient for developing a physics identity. They found that recognition and interest are also necessary for directly impacting identity as well as moderating beliefs about performance and competency (Potvin and Hazari, 2013). In other words, an individual must be intrinsically excited about the content and have their abilities recognized by others (e.g., mentors, peers, family) regardless of how academically high performing they may be.

Self-efficacy is a concept in psychological and educational research and has also been used as a predictor for academic success (Schunk, 1991). Psychologist Albert Bandura defines self-efficacy as "people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances" (Bandura, 1986, p. 391). Bandura asserts that it is important to understand and strive for self-efficacy resiliency of students in order to promote success in college (Bandura, 1989). He notes that students must have “a strong sense of efficacy to remain task oriented in the face of judgmental failures” (Bandura, 1989, p. 1176). This idea is supported by extensive literature throughout the decades that emphasizes self-efficacy as an important factor in STEM and in college in general (Hackett & Betz, 1989; Lent et al., 1986; Parajes, 1996; Williams & George Jackson, 2014). Estrada et al. (2011) described a feedback cycle of self-efficacy as a “rule of academia” stating, “If you perform as we want you to, you will be given positive feedback from our community, barriers will decrease, and you will be encouraged to continue” (Estrada et al., 2011, p. 3). These findings suggest a complex relationship between educators and students in maintaining and fostering self-efficacy. However, it puts substantial pressure on the student to essentially follow the status quo of a typical academic community in order to be successful. This idea is a bit limiting in that what is typical in
one community may not be typical in another. Additionally, as new generations of students and scientists are moving through the educational system, it is important to adapt and develop to changing needs of undergraduates (Griffith, 2010).

Taken together, themes of sense of belonging, science identity, and self-efficacy are theoretically and empirically integral in the success of undergraduates in STEM. Additionally, these concepts are linked in that they constitute a student’s internal support and self-regulation, yet are influenced by external factors primarily in a social context (Zaniewski & Reinholz, 2016). The peer group for the present study was structured to positively influence the students’ self-perceptions and to provide a distinct space to explore shared science identities and experiences.

**Social Support in STEM**

Research suggests that social support is an important component of the undergraduate experience and a significant contributing factor to a student’s ability to persist in his or her education (Gerdes & Mallinckrodt, 1994; London et al., 2011). Many studies have been conducted through the decades to support the idea that the social lives and emotional health of students play a huge role in their success (Brainard & Carlin, 1998; Gerdes & Mallinckrodt, 1994; Zaniewski & Reinholz, 2016). Indeed, students are certainly not experiencing college in a vacuum; learning occurs within social contexts and communities that have the ability to both help and hinder student progress through college (Vygotsky, 1962).

Longitudinal studies have been important contributors to identifying and understanding low persistence in STEM and frequently point to social/emotional wellness as an indicator and determinant of success. Gerdes and Mallinckrodt (1994) performed a longitudinal study of retention among undergraduates from a large northwestern US public university, utilizing the
Student Adaptation to College Questionnaire (SACQ) and the Anticipated Student Adaptation to College Questionnaire (ASACQ) to assess emotional, social, and academic adjustment of students (Gerdes & Mallinckrodt, 1994). They found that social and emotional adjustment items generally predicted attrition as well as or better than the academic adjustment items (Gerdes & Mallinckrodt, 1994). Similarly, Brainard and Carlin (1998) performed a six-year longitudinal study of undergraduate female students in science and engineering to determine an accurate measure of retention and to explain the factors that affect retention (Brainard & Carlin, 1998). While a variety of factors were identified as barriers affecting students’ ability to persist, many related to a lack of social support. Overall, students reported barriers such as intimidation, lack of self-confidence, poor advising, and not feeling accepted in their departments (Brainard & Carlin, 1998). On the other hand, students who persisted through their freshman year cited positive influences from faculty, involvement in their departments, and feeling supported by their mothers (Brainard & Carlin, 1998). Persistence factors from students’ sophomore year also related to social support; students expressed the importance of a positive relationship with their advisor as well as involvement in their department (Brainard & Carlin, 1998). As students moved into their junior and senior years, social support continued to play a role in their ability to persist. Positive relationships with mentors and seeing an academic advisor were important factors. Other influences included positive classroom experiences and participation in conferences and events (Brainard & Carlin, 1998). While many factors were identified, social support from faculty and family clearly played an important role, suggesting that this is a component of worth when considering students’ persistence in science and engineering.

Previous literature has identified social support as an important component of academic structures such as research, particularly via mentoring relationships (Crisp & Cruz, 2009;
Holland et al., 2012; Raman et al., 2015). Research opportunities are one component of an undergraduate education that can promote richer involvement, and numerous studies suggest that there are important social considerations with these opportunities as well (Raman et al., 2015). One of the most prestigious of these is the NSF-funded Research Experience for Undergraduates (REU) program. REU’s can be critical opportunities for undergraduates in STEM to boost persistence (Eagan et al., 2011; Gonzalez-Espada & LaDue, 2006; Hathaway et al., 2002). As part of these programs, mentoring is identified as an integral component for student success (National Science Foundation, 2013). Raman et al. (2015) explored the role and actions of mentors for STEM students in REU programs and hypothesized six key dimensions for effective mentoring: safe, prepared, proactive, patient, present, and positive (Raman et al., 2015, p. 366). Raman et al. point out that these key concepts may sound obvious or trivial, which represents a common problem, or a “great trap”, in education: mistakenly thinking that obvious items are being covered (Raman et al., 2015, p. 376). In this study, undergraduates generally reported better mentoring from graduate students rather than from faculty (possibly because graduate students can generally spend more time with mentees than faculty members). Raman et al. (2015) called attention to the importance of principal investigator (PI) mentoring in the REU experience and that it is a unique experience relative to other academic settings or mentoring of employees. Many other studies have also illuminated the role of mentors in driving success for undergraduates in STEM (Crisp & Cruz, 2009; Holland et al., 2012).

In a study more closely aligned with the present work, Zaniewski and Reinholz (2016) studied physics undergraduates’ success in relation to a near-peer mentoring program. They defined near-peer mentors as “a dyadic platonic relationship between a more experienced student (mentor) and a less experienced student (mentee) at the same institution, with frequent, direct,
face-to-face contact” (Zaniewski & Reinholz, 2016, p. 3). Each mentee was assigned a mentor with whom they met with on a bi-weekly basis. The researchers found that mentoring relationships successfully provided mentees with psychosocial and academic support, which aided in normalizing the struggles of the physics undergraduate experience (Zaniewski & Reinholz, 2016). The mix-methods study aimed to provide qualitative as well as quantitative measures of academic and programmatic success; however, the qualitative components were limited in terms of methods and scope. Zaniewski and Reinholz included excerpts from online reports and questionnaires from both mentors and mentees, giving a voice to the participants about the relationships formed over the course of the program. While these quotes highlighted the friendships that were formed and overall positive experiences of participants in both roles, they lack the context of a more rigorous qualitative study design. Nonetheless, results from this study clearly indicate favorable results from the program via positive relationships as well as academic success; the mean GPA of the mentees was 3.49 for their first semester (Zaniewski & Reinholz, 2016).

Taking a different approach to social support, Dugas et al. (2019) conducted a qualitative study of undergraduates in a weekend retreat designed to promote self-authorship. Following the retreat, post interviews were conducted to elicit student experiences. Participants described feelings of discomfort that were instrumental towards personal growth. These feelings were linked to challenging experiences such as being in unfamiliar settings, participating in small group processes, and overall experiencing uncomfortable emotions (Dugas et al., 2019). Findings from this study support the need for more intentional spaces for undergraduates to reflect and connect with peers, thereby providing opportunity for self-authorship. Dugas et al. suggest that
students need these spaces to be able to talk openly and have the courage to feel discomfort and to be among others who are also willing to take on these challenges.

Theoretical Frameworks

A number of theoretical frameworks were examined and connected to guide the methodology of data collection and peer group administration. Joining themes of self-efficacy, sense of belonging, identity, and adulthood, we call on numerous theories, including Baxter Magolda’s Theory of Self-Authorship (2004), Arnett’s Theory of Emerging Adulthood (2000), Bandura’s Social Cognitive Theory (1986), and Tinto’s Model of Student Retention (1975). Bandura’s Social Cognitive Theory and Tinto’s Theory of Departure are commonly applied to persistence studies, while self-authorship and emerging adulthood are predominantly within the developmental psychology literature. We draw from both areas in an attempt to bring an interdisciplinary and holistic approach to understanding how and why STEM students persist.

Persistence Theories

This study is informed by Albert Bandura’s Social Cognitive Theory (1986) as well as Social Cognitive Career Theory, adapted from Bandura’s original theory by Lent et al. (1994). Social Cognitive Theory describes the nascent interactive agency of people by explaining that humans are not entirely autonomous in their actions but rather connected to their environment and its influences (Bandura, 1989). Within this model sits the notion that there is a “reciprocal causation” occurring as well, where people are shaping their environment and their environment shapes them (Bandura, 1999). This directionality means that people are “producers as well as products of social systems” (Bandura, 1999). This presents a direct conceptual link to this study in that it is essential to recognize that students play both of these roles in their educational experiences.
Bandura also states that self-efficacy guides one’s goals, therefore their expectations, motivations, and the amount of work they will put in to reach those goals (Bandura, 1989). This notion that students’ self-efficacy plays a key role in their overall experience as an undergraduate in STEM is essential for the present study. Social Cognitive Career Theory, a more specific tenet of Social Cognitive Theory, was first described in 1994 by Lent et al. and presents a framework for understanding three aspects of career development: 1) the formation and growth of career interests, 2) selection of academic and career choices, and 3) performance and persistence in academic and career choices (Lent et al., 1994). This framework describes personal agency and “extra-personal factors” that enhance or limit personal agency in the career development process (Lent et al., 1994). The guiding principles of Social Cognitive Theory and Social Cognitive Career Theory provide a strong justification for studying the lived experiences of the students to identify and explain supports and challenges that influence their ability to persist through college and beyond.

Vincent Tinto’s extensive work on student retention also provides important framing for this study. Tinto’s (1975) original model asserts that the decision to drop out of college is based on the combination of student characteristics and the academic, environmental and social integration one experiences in an institution. Tinto’s later work, the Model of Student Retention (Tinto, 1988), builds on these concepts. The Model of Student Retention describes a process of student persistence and departure as “being made up of distinct stages” that college students pass through in their college careers (Tinto, 1988). Tinto calls on Dutch anthropologist Arnold Van Gennep’s classic study, *The Rites of Passage*, in describing stages of separation, transition, and incorporation that “move individuals from youthful participation to full membership in adult society” (Tinto, 1988, p. 440). Tinto emphasizes the importance of community in these stages
and that there are numerous challenges that tend to arise when one moves from community to community during one’s educational experience. This relates to the goals of the peer group for this study in that the group was intended to provide a distinct community aimed at helping students address psychosocial needs, which was particularly important for students who had just transferred from community college.

Additional work investigated the effect of financial aid on persistence in the context of Tinto’s theory. In an empirical study, Nora (1990) investigated campus-based aid as a determining factor of persistence and retention for Hispanic students from a two-year college and found that aid (e.g., campus-based and outside funds) had a significant impact on student success. Findings from similar studies also support the importance of financial aid (Bers & Smith, 1991; Porter, 1991) and suggest further research to examine the influences of academic and social integration as well as financial aid on student persistence.

Adulthood Theories

In recognition of the fact that our participants, being college students, are in a particularly challenging and unique phase of their lives, we called on the work of Baxter Magolda and Arnett to frame our study to also acknowledge the ambiguity, crossroads, and identity development faced by young or “emerging” adults (Arnett, 2000; Baxter Magolda, 2004). These theories have an important place in this research, as they provide additional context into the challenges of persisting in STEM. After all, college students of traditional ages are developing not only as scholars, but also as people, challenging and forming belief systems, reaching and/or approaching traditional adulthood milestones (such as having children, gaining financial independence, moving out of parents’ homes, etc.), and ultimately becoming the authors of their lives. The highly transitory phase of college encompasses more than just supports and
challenges in STEM, but also highly important factors from other internal and external factors such as identity development, familial obligations, and financial stresses.

Baxter Magolda defines self-authorship as “the internal capacity to construct one’s beliefs, identity, and social relations” (Baxter Magolda, 2014, p. 25). In contrast, a person may operate out of external formulas determined by teachers, family, or peers. In other words, a person’s internal capacity is also influenced by outside variables. The concept of self-authorship has implications for one’s experience in college given the many complex tasks, choices, relationships, and other factors that take place over the course of a college career. Baxter Magolda’s Theory of Self-Authorship (2004) describes a model of development towards the aforementioned capacity (defining one’s beliefs and identity) via crossroads that may present both supports and challenges. Crossroads occur for individuals when their learned or preconceived ideas are met with recognition of different sources of contradicting information, thus making it challenging to rely on previous knowledge to determine the correct course of action. Young adulthood, particularly college, is a time rich with crossroads. It is important to note that inherently these experiences are not limited to academic settings. Students’ lives extend outside of the classroom, where new experiences, challenges, and opportunities are shaping and influencing them constantly. Baxter Magolda’s theory takes an especially important role in this particular research in that this framework provides a pathway to the heart of student experience—the tough decisions, the internal and external voices, the supports and challenges. Baxter Magolda’s work is also significant for her emphasis on the role of young adults becoming “authors” of their own stories. In other words, she asserts that their experiences and the sense they make of them play a critical role in development towards adulthood.
Arnett’s Theory of Emerging Adulthood (2000) also provides a framework to consider the attitudes and experiences of the scholars in the peer group. Arnett coined the term “emerging adult,” giving a name to the ambiguous period of time faced by those in the murky post-adolescent waters somewhere between 18 and 25. This phase of life is described by Arnett as a time marked by considerable opportunity, but also one of difficulty filled with many choices and the resultant anxiety that can accompany having to make them. Arnett proposes that in this distinct phase of life, young adults from all over the world are demographically similar in ways such as delayed marriage and prolonged years of education. While this assertion in particular has landed Arnett fairly substantial criticism, it is nonetheless a fair assessment of young adults’ experiences for the US in particular, where this study took place.

From a theoretical standpoint, there is a necessary role for social support for college students. This is also supported extensively in the literature; there is quantitative evidence there is a persistence problem in STEM (Crisp & Cruz, 2009; Holland et al., 2012; President’s Council of Advisors on Science and Technology, 2012) and numerous lines of evidence pointing to the role of social/emotional wellness and relationships in whether or not a student persists (Brainard & Carlin, 1998; Estrada et al., 2011; Gerdes & Mallinckrodt, 1994). This project is unique in its programmatic and methodological approach to supporting and understanding the experiences of financially challenged STEM undergraduates in high academic standing. This group provides perspectives not often represented in the current existing literature, as well as a novel approach to providing social support. Using a case study design, I bring together multiple data sources in order to bring awareness to the voices and lived experiences of the scholars as they experience structured social support. Here, I have delineated these voices together to tell a
story with the hopes of contributing to a growing body of research aimed to improve undergraduate experiences and successes.

This project bolsters previous research that aims to shed light on persistence in STEM, more explicitly, what keeps students going and what factors get in the way of their paths. Given the overwhelming number of factors and the highly personal and complex nature of persistence, qualitative research is highly appropriate for this work, specifically to access the lived experiences of the BELONG in STEM scholars. By providing a space for students to openly share and connect, developing relationships and building trust, this project allows an in-depth and contextualized glimpse into the experiences of the scholars.
CHAPTER 3. METHODS

Methodology Overview

This study addresses research questions regarding supports and challenges of the students leading up to the scholarship program as well as the overall experiences and impacts of participating in the weekly peer group during the fall 2019 semester. This qualitative study follows an instrumental case study design, a type of ethnographic research that serves the need for understanding a phenomenon by examining a particular case (Creswell, 2015). In this study, the case is the initial cohort of BELONG in STEM scholars in the near-peer-mentored support group (N = 12). Case studies aim to provide a detailed explanation of a particular group or occurrence rather than making grand generalizations about a phenomenon (Creswell, 2015). Instead, case-specific “petite generalizations” (Stake, 1995, p. 7) are garnered from this study. Given the personal and socially/emotionally complex nature of persistence, the research methods were appropriate in order to describe the lived experiences of the students in the peer group. The intention is not to make assumptions about all STEM undergraduates’ experiences, struggles, triumphs, etc.; rather, the goal of this study was to provide a detailed account of students’ experiences related to persistence through the lens of a weekly peer-mentored support group. As with most case studies, triangulation is an important aspect of the data collection process in order to solidify concepts and validate findings (Carter et al., 2014). This was accomplished via interviews with students at the beginning of the program, a focus group interview, and weekly reflections from myself as the researcher.
The students were compensated for the interviews and focus groups. Figure 1 provides a visual overview of the methods as well as a timeline detailing when data was collected.

Figure 1. Overview of case study methodology. Three data sources were used to triangulate findings about the supports and challenges impacting the students’ ability to persist in their STEM degrees. Data collection took place over the course of the Fall 2019 semester.

Research Questions

To understand the supports and challenges that students have experienced both prior to and during the group, we posed the following research questions:

1. What sources of support do students commonly reference prior to the program?

2. What challenges do students commonly reference prior to the program?

3. How do students describe their experiences in the group as a support or challenge?

4. What do participants describe as significant impacts from the group?
Description of Setting

The research setting for this study was a mid-sized public, high-research-activity university campus in the Midwest US with a total enrollment size of 16,609 and an undergraduate population of 12,131. International students represent 921 individuals from 103 different countries. The average undergraduate age is 22 with roughly 49% males and 51% females. Ethnicity of the entire university population is 51.5% White, 19.3% Hispanic/Latino, 17.4% Black, 5.7% Asian, 3.7% two or more races, 1.9% non-resident alien, 0.1% Native American, 0.1% Native Hawaiian, and 0.2% unknown. Additionally, 50% of graduating classes are transfer students. The university is located in a city with a population of 43,862 according to the 2010 Census. Compared with national statistics, this university is considered to have above-average ethnic and gender diversity (U.S. Department of Education, National Center for Education Statistics, 2019). According to a 2017 institutional data report, the university also has a higher percentage of first generation students (48%) and students receiving federal aid (94%) compared with national averages (34% and 83%, respectively) (Institutional Research Office of Institutional Effectiveness, 2018; U.S. Department of Education, National Center for Education Statistics, 2019). Overall retention rates for STEM majors for the university (45%) are very similar to the national average of retention of STEM students (40%) (Institutional Research Office of Institutional Effectiveness, 2018; President's Council of Advisors on Science and Technology, 2012)

Description of Participants

Participants for the study (N =12) were all recipients of the BELONG in STEM scholarship, marking the first cohort of the five-year program. Six students were community college transfers; the other six were previously enrolled at the study university. All but one of the
students, a senior, were in their junior year. Students were approximately evenly mixed by
gender, traditionally college aged and of various racial backgrounds (Figure 2). Half of the
students were also first-generation college students (Figure 2).

Figure 2. Demographic information for the BELONG in STEM scholars.

As previously stated, in order to be eligible for the scholarship program, students needed
to be enrolled in one of six designated STEM majors. Table 1 below shows the breakdown of
majors for the twelve students in the group.

Table 1

Students’ Academic Majors

<table>
<thead>
<tr>
<th>Major</th>
<th>Number of Students Enrolled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry or biochemistry</td>
<td>6</td>
</tr>
<tr>
<td>Mathematics</td>
<td>2</td>
</tr>
<tr>
<td>Biological sciences</td>
<td>1</td>
</tr>
<tr>
<td>Computer science</td>
<td>1</td>
</tr>
<tr>
<td>Geology and environmental geosciences</td>
<td>1</td>
</tr>
<tr>
<td>Physics</td>
<td>1</td>
</tr>
</tbody>
</table>
Weekly Meetings

Weekly peer group meetings (11) were held during the evening in a common room (Figure 3) in a residence hall on campus over the course of the Fall 2019 semester. This space was selected for its accessibility and central location as well as its privacy from other campus life. Students were provided dinner prior to the meeting. No data was collected during the meetings to maintain the integrity of the peer group experience; however, I answered a series of reflective questions to journal my viewpoints and experiences following each group meeting (Appendix D).

![Figure 3. Photo of weekly meeting space](image)

Although a set curriculum or list of activities was not strictly established from the onset, I met with a mentor weekly to plan and discuss activities for upcoming groups and to debrief the previous week’s meeting. Examples of activities include team building, icebreaker games, sharing of current happenings (e.g., weekly highs and lows), and prompted discussions using art, poetry, and songs. One particular example is The Strange Trails Activity. I shared an album with the students that was particularly impactful to me during my own previous struggles to persist:
“Strange Trails” by Lord Huron. We listened to a one of the songs while looking over the lyrics (Appendix F), then I had the students answer questions on a handout (Appendix E) that I created to prompt a discussion that encouraged students to think about their own “strange trails.” Then students took turns sharing their responses and connected to each other’s experiences. Their feedback regarding this particular activity is included in the discussion of findings in Chapter 4.

**Intake Interviews**

Individual intake interviews were completed in late August during the first two weeks of the fall semester. Prior to the interviews, students were familiarized with what to expect from the peer group and also asked for consent to participate in the interview and for audio to be recorded. These interviews were conducted in a private office space. Participants were given a consent form (Appendix B) to read and sign (with IRB approval no. HS18-0183, see Appendix A), as well as verbal explanations and opportunities for questions or concerns. Interview times ranged from 30 to 75 minutes in length. A semi-structured interview guide was followed, including follow-up questions (Appendix G). The purpose of the interviews was two-fold: (1) for me to get to know the students and their backgrounds and (2) for baseline data regarding students’ supports and challenges prior to the start of the program. Questions were framed to highlight students’ previous lived experiences in school and STEM in particular. For example, to understand students’ previous supports, I asked: “School can be tough! Who/where do you turn to for support?” Specific questions were aimed at understanding students’ relationships as well, for example: “Describe your interactions with your peers as an undergraduate.” Additionally, students were asked about “high points” and “low points” in their undergraduate experience thus far in order to further access stories about particularly supportive or challenging times. Follow-up questions such as “Can you provide a specific example?” were often asked in order to provide
more narrative context regarding the students’ experiences. Students were compensated $20 in cash for their participation in this interview. The recordings were stored in a password-protected electronic location and then transcribed using a third-party service.

**Researcher Reflections**

Following each group meeting, I answered a series of reflective questions to record a general overview of the conversations and interactions between students, as well as my feelings, opinions, and concerns about the meeting. These reflections were discussed each week with my mentor, who has a background in educational psychology and who had run similar groups in the past. The reflective questions are included in Appendix D.

**Focus Group Interview**

To elicit both shared and individual experiences from the group, I conducted a focus group interview during the second-to-last meeting of the Fall 2019 semester. Careful consideration was taken regarding my decision to conduct the interview; students were asked weeks ahead of time whether they would prefer an outside researcher to run the interview instead, allowing them to decide what would be more comfortable for them in terms of being able to freely discuss their feedback and experiences. The students unanimously chose for me to run the focus group interview. The interview took place in the same setting as the weekly peer meetings and lasted approximately 1.5 hours. The semi-structured interview guide (Appendix G) was reviewed by multiple independent researchers for clarity and validity. Students were compensated $30 in cash for participation in the focus group interview. The focus group interview protocol was framed with a similar “supports and challenges” framework as with the intake interviews but focused entirely on experiences within the group and impacts felt both within and outside of the group as a result of participating. For example: “What was a high point
during the peer group this semester?” or “What is one way you see this group differently now than you did at the beginning of the semester?” To specifically ask about supports from the group, I asked, “In what ways did you feel supported by the group?” Students were also asked to describe stories about challenging aspects of being in the group. Follow-up questions, such as “Any other [opinions] from other members?” were asked in order to elicit opinions from as many students as possible, especially when I noticed that certain students had not participated as readily as others.

Analysis

All transcripts were generated from the recordings via a third-party company, TranscribeMe, edited to correct any errors and remove names and majors, and broken into units of analysis manually before inputting the data into a coding program. Units of analysis were determined by reading through the transcripts and identifying blocks of text based on theme. Coding of all qualitative data was performed using an open-sourced program, the Coding Analysis Toolkit, or CAT (https://cat.texifter.com). Multiple rounds of descriptive coding were carried out for all data and dual coding was performed on the focus group interview and a subset of the intake interviews to ensure reliability of the coding rubric. Descriptive coding, also called “topic coding,” is a means of summarizing the basic topic of a passage of qualitative data by applying a single word or short phrase (Saldaña, 2016).

Intake Interview Coding

I first coded the interviews to identify main categories of “supports and challenges.” After initial creation of the subsequent coding manual, coding was performed in three rounds for the intake interviews. First, three out of the twelve interviews were coded independently by two researchers (an additional researcher and myself). Percent agreement values (“valid” codes
divided by “invalid” codes) were then calculated following a validation process to decide which codes to keep and which to remove. This is known as inter-rater reliability, a method of ensuring trustworthiness and reliability of the coding scheme and the coders themselves (Creswell, 2015). For this study, the inter-rater process was used mainly to refine and improve the robustness of the coding manual, better defining the scope of each code. Eighty percent agreement was determined as our goal, based on similar accepted statistics (e.g., Kappa value) for qualitative research (McHugh, 2012). Agreement was calculated as the percentage of total agreed-upon selected codes compared with the total selected codes. Codes that were not selected were not factored into the agreement calculation. After the first round of independent coding, agreement was less than 80% for all three interviews. At this time, the coding rubric was discussed and refined. In the next round of coding, the two researchers co-coded a single interview to improve the rubric and reliability by discussing the rubric in real time. Agreement was again below 80%, so the rubric was again discussed and refined. During the third round, three interviews were re-coded independently and percent agreement was between 82% and 87%, thus greater than 80% agreement was achieved. At this time, I continued coding the rest of the intake interviews individually. A spot check—an additional process of independent coding—was performed on one final interview that had not been previously coded by either researcher to test the reliability of the final coding scheme, and 90% agreement was reached. A list of codes, definitions, and example quotes from the intake interview coding rubric is presented in Chapter 4.

**Researcher Reflections Coding**

The researcher reflections were first coded with the “supports and challenges” framework by myself, given that they were my own words and experiences. After compiling a list of all emergent themes generated from the first round, they were consolidated into a more refined
grouping of codes (Appendix H). These codes were refined to fit with the previous coding schemes for the intake interviews and focus group in order to highlight parallels from different data sources. Each reflection was then re-coded using the refined coding manual.

**Focus Group Coding**

As with the intake interviews, I first coded the focus group to identify main themes. The coding rubric was then created to reflect the “supports and challenges” framing of the study and to highlight the main takeaways from the students’ experiences in the group. The focus group interview was co-coded (side-by-side) by the same two researchers in its entirety, and changes to the coding manual were discussed and made in real time. A list of codes, definitions, and example quotes, is presented in Chapter 4. For a more robust examination, Appendix H also provides a table with information about modifications and changes made to the three different rubrics during the coding and inter-rater process.

**Researcher Role, Positioning, and Power**

As the primary researcher for this study, I held several distinct and related roles. First and foremost, I served as the near-peer mentor and leader of the weekly group meetings. From the outset, I was very explicit with the BELONG in STEM scholars about the boundaries of my position in that I am not a counselor nor psychologist. I communicated information about the meetings with qualified staff from the university counseling center to obtain resources and establish a point of contact for any future needs. Additionally, I attended multiple diversity and inclusion workshops during the summer of 2019 in preparation for working with a diverse group of students and for training in group processes and facilitating. In addition to my role as a mentor for the students, I also carried out all components of the IRB-reviewed (no. HS18-0183) qualitative research for this project: the intake interviews, the weekly reflections, and the focus
group interview. Careful consideration was taken when deciding who should be in these roles. Ultimately, in an effort to create a sense of trust and community between myself and the students, as well as the most authentic data collection, it was decided that I was best suited to carry out each of the methods. Consistent monitoring from other researchers on this project ensured that ethical precautions were met and bias was minimized as much as possible, recognizing that it is an unreasonable task to entirely remove bias from case studies such as this. Additionally, it is a common practice in ethnography for the researcher to have an immersive role in the group of individuals being studied and to be considered an “instrument” in the research (Given, 2008; Xu & Storr, 2012).

As a former STEM undergraduate myself, I carry my own stories of highs and lows, of supports and challenges, of persisting and departing. Therefore, it is important to briefly describe my own lens in this research. Overall, I have struggled to find my own sense of belonging in all of the STEM settings I have been in, from high school to my undergraduate career to graduate school. I have often questioned my own path, capability, and resiliency. I have also grown to develop my own identities as an adult and a scientist—identities that have been shaped by many different supports, challenges, and self-regulations. This is therefore a lens through which I look through when approaching this research. This also made it easier to relate to the students’ feelings and experiences; I believe it ultimately made my connection to the project and the students themselves that much stronger. There were certainly overlaps between my own supports and challenges and those of the students, which in many instances made understanding and sympathizing with them an easy point of entry for earning their trust as a leader. However, I did my best not to impart my own truths on my interpretations of student experiences. Post group journaling was in part to combat this potential source of error, as well as the inter-rater process
during coding of the intake interviews and side-by-side coding of the focus group interview. I sought substantial objective evidence to back up any claims while also recognizing that it is virtually impossible to entirely remove assumptions and subjectivity from qualitative research. In general, the methodology of ethnography does not strive for objectivity (Hegelund, 2005). Rather, it is the immersive nature of qualitative work that is useful for accessing unique and rich viewpoints and experiences from multiple sources.

It is also important to foreground a power dynamic in my role as leader in the group. This may have impacted students’ willingness to be forthright with me during our intake interviews and the focus group, as they might not have felt entirely comfortable to share personal stories and feelings with someone in an implied position of power in the scholarship program. As a component of the scholarship program, the scholars were also required to attend the weekly meetings. My position as leader of the group meant that I was also tracking attendance and tardiness; therefore, I was in a place of authority with regards to their standing in the scholarship program. Attendance was very seldom an issue in that boundaries were clearly set by the project team, including faculty members, and students almost always met expectations about communication and showing up for meetings.
CHAPTER 4. FINDINGS

A discussion of the most salient findings will be presented by research question and triangulated with multiple data sources. In this section, intake interview and focus group coding schemes will also be provided. While general themes emerged from the data, no two students’ experiences were exactly alike. Therefore, careful measures were taken to ensure that individual student voices were well balanced in this report. Even on an individual level, each student’s story was quite complex.

Table 2 provides the resultant codes and example quotes for the intake interviews. Similarly, codes for the focus group interview will be presented in a table later in this section.

Findings Prior to the Peer Group

1. What sources of support do students commonly reference prior to the program?

Students described many different sources of support, ranging from self-regulation (coded “internal/self”) to very impactful relationships with people within and outside of the academic setting. Table 3 provides total occurrences of codes and the number of students who discussed said codes.
<table>
<thead>
<tr>
<th>Theme</th>
<th>Subtheme</th>
<th>Definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supports</td>
<td>Relationships</td>
<td>Verbal or nonverbal communication, input, or connections with others (e.g., family, friends, peers, instructors) that participants describe as emotionally/psychologically helpful and/or as having had a positive impact on their academic and/or personal development (e.g., being encouraged by a professor versus attending a professor’s office hours)</td>
<td>“...And so my teacher saw that interest and she advised me to take the career path... She said it’s a long road but she definitely saw that I had great interest in it that she did not see in her other peer students...” – Andre</td>
</tr>
<tr>
<td></td>
<td>Internal/Self</td>
<td>Intrapersonal events, thoughts, actions, or inner voices that participants describe as having had a positive impact on their academic and/or personal development (e.g., choosing to work individually on coursework, exceeding one’s own expectations of self, reassurance from self)</td>
<td>“It was just hard to be there, so to the fact that I pulled myself out of that, and I’m going to a university. And then I’m doing the damn thing... I’m proud.” – Helen</td>
</tr>
<tr>
<td>Challenges</td>
<td>Academic</td>
<td>External resources or experiences related to one’s education (e.g., conducting research, attending a professor’s office hours, receiving scholarship money) that participants describe as emotionally/psychologically helpful and/or as having had a positive impact on their academic and/or personal development; may include individual people who participants describe as having provided guidance, information, or other academic resources without otherwise mention of a distinct relationship (e.g., visiting a tutor or attending office hours)</td>
<td>“Probably my speech class was a high point. Just because I really hate public speaking. And it's just kind of-- it really made me feel more comfortable in doing that.” – Fiona</td>
</tr>
<tr>
<td></td>
<td>Academic</td>
<td>External resources or experiences related to one’s education (e.g., high workload, difficult course content) that participants describe as emotionally/psychologically unhelpful and/or as having had a negative impact on their academic and/or personal development</td>
<td>“So the accountability and just the huge workload that comes with it has definitely been the hardest part for me.” – Shelby</td>
</tr>
</tbody>
</table>
|            | Internal/Self  | Intrapersonal events, thoughts, actions, or inner voices that participants describe as having had a negative impact on their academic and/or personal development | “Well, freshmen year I failed the first [science field] exam just because I wasn’t really prepared for

(Continued on following page)
(e.g., internal feelings of inadequacy, time management) just how they were asking the questions and stuff. And I wasn’t ready for it.” – Dan

Verbal or nonverbal communication, input, or connections with others (e.g., family, friends, peers, instructors) that participants describe as emotionally/psychologically unhelpful and/or as having had a negative impact on their academic and/or personal development (e.g., being discouraged by a professor versus no learning gains during a professor’s office hours) “But they didn't think I would be able to handle the advanced classes. So that was pretty crazy… Oh, my math teacher. She acted like she wanted me to go in there, but she didn't care.” – Sonia

Individual events that participants describe as emotionally/psychologically unhelpful, stressful, frightening, or traumatic and/or as having had a negative impact on their academic and/or personal development (e.g., being assaulted) “My grandma was in the hospital… And then three of my dad’s side of my family were in the hospital… And then I had to go to a memorial for my friend who had committed suicide that semester. So I was emotionally a mess…” – Beth

Table 3

Occurrences of “Supports” Codes from Intake Interviews

<table>
<thead>
<tr>
<th>Supports</th>
<th>Total Counts</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relationships</td>
<td>127</td>
<td>12</td>
</tr>
<tr>
<td>Internal/Self</td>
<td>122</td>
<td>12</td>
</tr>
<tr>
<td>Academic</td>
<td>65</td>
<td>12</td>
</tr>
</tbody>
</table>

“Total counts” refers to the total number of times when a quote was categorized into each code based on all twelve interviews. “Number of students” refers to the number of individual students who contributed at least one quote for each code. For example, in the intake interviews, all 12 scholars contributed at least one quote for each code category under “supports”.
**Internal Supports**

While many of the supports were described as occurring within an academic setting, they were often indicative of self-regulation, which was coded as “support – internal/self.” For example, Dan described persevering through a difficult science course during his first year of college. After failing the first exam, he stated:

“…I just tried new options for starting, instead of just doing the homework, I would review the notes and look up more practice problems and more examples and stuff. I went in for more help. I took advantage of restitution hours and stuff better, not just sitting there.” -Dan

Here, Dan demonstrated a clear internal drive to succeed despite the initial struggles of failure and feeling unprepared. He made the decision for himself to seek out new resources and means of learning course material. This type of internal drive was a very common theme among the students, as shown below:

“I think it was 50 hours or 60 hours we had to do in order to pass the class. I did 80. I wanted to do more. Give me as many as you can.” -Harold

“Passing calc two? …Yeah. So that was like the hardest thing I've ever in my life. Like I said, I was at the tutors and YouTube every day. I would devote, God, two to three hours a day of just studying it and it was like mental jumping jacks. It was insane.” – Nicholas

“I pretty much put pressure on myself for everything. I don't know. I just want to be, I just want to be the best I can be and in everything I do. Not necessarily like I want to win, win. But I just want to do my greatest. I want to be kind to everyone I can meet.” –Helen

In the next quote, Harold describes feeling an inner feeling of confidence regarding getting into graduate school based on the experience he has pushed himself to accomplish:

“Yeah. I'm definitely confident. There's people who I've known who applied to that school and they're very confident about getting in and they have less experience I need, so I hope with my experience, I should be all right.” -Harold
When asked about how she made it to a point in her education where she exceeded her own expectations, Fiona explained her work ethic as well as other factors that contributed to her success, particularly the fact that her parents encouraged her not to work but rather to focus on school:

“Probably just my work ethic... I would not go to bed until I had everything done. I just couldn't.... And also, the fact that I didn't work in high school. A lot of my friends would work and they had that extra baggage that they had to deal with. And I was lucky enough my parents to be like, ‘No. Just focus on school and everything.’ So I was really happy that I didn't have to deal with working those late hours and stuff like that.” -Fiona

Here, Fiona cites her own work ethic as well as a relationship structure among her and her parents.

**Relationship Supports**

In general, relationships were the other more commonly cited source of support for many of the students, with a range of individuals mentioned such as family members, teachers, peers, and mentors.

“So being able to talk to family and friends has been helping. Especially my friends, because some of them are also in hard classes as well. So it's nice to relate to them even if they're not the same school I go to now. My best friend, she's pre-med so she's got a lot going on, too. So it's nice to be able to relate that way.” –Christina

“My mom... she's very supportive. She helps me out with bills and all that and she always pushes me to do better.” -Harold

Nicholas discussed receiving support from a number of different individuals in his current college experiences:

“Yeah. I mean, [my parents] were always supportive [of] what I've really wanted to do, but having them approve of it definitely impacted it and cemented the fact that what I've thought I wanted to do was good and would be good for me...”

“...Academically, yes. Definitely. I feel like I could turn to any of the professors, depending on what my question was, and they would make the time to help me. Emotionally, yeah. I would agree with that too. Maybe a smaller pool of people than academically, but there's people that I would turn to.” - Nicholas
In the next quote, Andre talks about an ongoing relationship with a former high school teacher who has provided him with both academic and nonacademic guidance:

“But there is that one person [who] always... stays in touch with me a lot, and that would be my high school teacher... sent her a message, like, ‘this happened and I'm really bumbled out’... I always look forward to her response... And that's definitely that one person I would completely trust a lot. After all, she did guide me on a good path.” - Andre

Next, Fiona describes familial support from her lens as a first-generation college student with immigrant parents:

“Well, [my parents] were really supportive because that's why they wanted to come here, because they wanted something better for me. I feel like if we were still in [country], I'd probably be married by now and have two kids or something. So it's good. They've always supported me. They don't really always have the resources to because they don't know-- it's just as foreign to them as it is for me..” – Fiona

**Academic Supports**

Although generally not as frequently discussed as internal or relationship supports, a variety of distinctly academic supports were brought up as well. For some individual students, however, supports falling into the “academic” bin were in fact more prevalent. Scholarships were commonly referenced as supports or otherwise notably important in students’ academic journeys, which was not surprising given their demonstrated high financial need. This can be seen in the following quotes:

“The proudest moment? Oh, yeah. Getting this scholarship. BELONG in STEM scholarship. Yeah. This was like the first--no, actually, second official scholarship that I got.” -Pascal

“I think it was definitely getting into this program. That was kind of a surprise. I wasn't sure if I was going to make it in. So that was definitely a high point.” -Sonia

“And then I got that scholarship. And it was at first really hard for me to say yes because I was really excited to leave home and try something new, but I knew that it was a really big opportunity. And I'm really glad I took it because now I have two years of education, basically free.” -Christina
“Definitely the rewarding part, just to keep it simple is just the financial aid because STEM majors have that great resource of having that financial aid, especially for the community that I come from...” -Andre

Other items such as a positive school or classroom environment also were categorized as “academic supports.” These quotes demonstrate the importance of a more general feeling of support from instructors and institutions. First, Gia describes school as an enjoyable experience:

“It was really nice. I know [my home city] has one of the best school districts and I felt that when I was taking classes, even when I was little. I enjoyed my classes, my teachers, and everyone around me. So it's always been a positive experience...” -Gia

In the next quote, Fiona depicts a particular class that pushed her outside of her comfort zone and provided her with a meaningful life skill:

“Probably my speech class was a high point. Just because I really hate public speaking. And it's just kind of... really made me feel more comfortable in doing that. And I know it's something I really need to be comfortable with because that's what I'm going to do every day. So I felt like... ‘Oh, okay. I feel more confident in being able to speak in front of people.’” -Fiona

It was fascinating to learn about the students’ educational experiences leading up to the start of the peer group and also encouraging to hear so many different types of supports that have allowed them to make it to this point in their education. Each one of the students demonstrated a strong internal drive to succeed; however, they did not get to that point on their own. Influences and guidance from other people and academic resources also helped them in cultivating their academic success. Although not coded as a category within supports, “interest in STEM” was probed in the interview and analyzed given its relevancy to each of the students’ academic experiences. Appendix I contains an explanation of this code and a brief discussion of findings. It is omitted in the results because it is beyond the scope of the research questions for the present study.
2. **What challenges do students commonly reference prior to the program?**

Unlike with supports, it was more difficult to decipher which category of challenges was generally most prominent among the students prior to entering the BELONG in STEM Scholarship Program. Challenges related to academics, internal/self, and relationships were nearly equally represented in overall combined occurrences (Table 4).

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Total Counts</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic</td>
<td>44</td>
<td>11</td>
</tr>
<tr>
<td>Internal/Self</td>
<td>41</td>
<td>11</td>
</tr>
<tr>
<td>Relationships</td>
<td>38</td>
<td>9</td>
</tr>
<tr>
<td>Specific Events</td>
<td>9</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 4

Occurrences of “Challenge” Codes from Intake Interviews

Note: “Total counts” refers to the total number of times when a quote was categorized into each code based on all twelve interviews. “Number of students” refers to the number of individual students who contributed at least one quote for each code.

**Academic Challenges**

Academic challenges were often described in terms of high workloads and time management:

“Just the workload [laughter]. There's just nothing much to it. When I met with my [STEM] advisor, he advised me, 'So you're going to do it in a two-year path. And you're going to do five courses this semester, six courses the next semester.'” -Andre

“Probably my senior year, I was in college English. And I enjoy writing and everything. It was very heavy. So that was a dual credit class... And there [were] some nights where it'd be like three o'clock in the morning, and I'd be working on this paper. And of course, I had no idea. That's just what college is.” -Shelby

“My first semester last year… I was actually working two jobs and taking 18 credit hours. And I don't want to do that again. I learned my lesson. It was really stressful. I was barely sleeping. It was almost discouraging... First semester last year was rough.” -Sonia
Academic challenges in STEM were also explained by the students in terms of particularly difficult course content:

“I feel like these classes are very high pressure I guess and then also very difficult as they are going to be so that's just-- I want to say that's the most difficult part about being in it.” - Gia

“The subjects. I mean, they're very complicated and first off things that seem simple [are] so complicated. And I just think that's hard. And because I am so interested in it. I want to do well so when I don't understand something I get so frustrated. And I just think the material is hard.” - Helen

“It was probably just through sophomore year, I realized that it was a lot more. I think I remember feeling like when I started sophomore year that my freshman teachers definitely babied us the first year because I ended up-- I had three AP classes. And it was just like the first day I felt instantly overwhelmed.” - Christina

In the next quote, Pascal describes a particularly negative experience in a STEM course as a result of “bad teaching” from an instructor:

“From that time until now, I feel less interested... Not that I'm going to stop. I have to go do it. But I feel less supported... In that class... he was the only professor who taught that course, since he's [the] department chair... he controls who gets to teach. Yeah. Evil genius. He's a very smart professor. I respect that. But his teaching style is very bad.” - Pascal

While students frequently described their internal drive to push through such academic challenges like Pascal’s negative experience in a class, it was also quite common for students to discuss their inner dialogues in a negative or doubtful light. Such quotes were categorized as “challenge – internal/self.” Many of the students appeared to be harsh critics of themselves, as illustrated in the following quotes:

“My grades dropped a little bit… I was upset... I'm just not going to be able to get back up anymore. But it feels like, ‘Maybe it's you. Maybe you need to start changing some things.’...I was pretty upset about my grades. I got all B's, and I was like, ‘This is not right.’ Because I'm usually the type to get [a] 4.0... I was mad.” - Sonia

“It was definitely a struggle that I had to push through and it was frustrating at the same time too because I was kicking myself for not learning it in the first place when I should have learned it.” - Nicholas
In the following quote, Beth shows the double-edged sword of being a “perfectionist,” acknowledging her work ethic and also the tendency for it to become unhealthy:

“I have an innate drive to do well. I was a perfectionist in grade school... my best friend and I... we would compete for grades, which wasn't healthy. But I was upset one time because she got a 99 and I got a 97. It was one of those things. So I still kind of have that little innate drive to do well.” –Beth

Some students also reported pushing themselves to extreme levels of work and physical exhaustion:

“...There was a point where I will literally work and probably forget about eating. And that kind of led me to be diagnosed with anemia for my high school year, just because I just worked so many hours in AP courses. I just got so distracted.” -Andre

“...in November... I was just not sleeping at all... I actually ended up in the emergency room because my body was like, ‘Nope, we got to stop. We're not doing that anymore.’ ...that was rough.” -Shelby

Referencing back to the previous section, students often expressed a resilient inner drive to push through such negative experiences and emotions. In fact, following the discussion of many internal struggles, students often expressed lessons learned or personal growth that resulted from persevering:

“But I know I had to get through it and do it so I just did it. But it was rough. But looking back on it now, like I said before, I'm glad I did it. Proud that I made it through. So it doesn't really bother me now.” -Nicholas

“And I've always-- when I was little, I wanted to be a [chemist]. It's what I wanted to be, but then life happened. And I was like, ‘No way I can do that,’ and then I was just like, ‘You know what? I can try. Who knows if I'll make it? But why not try?’” -Helen

**Relationship Challenges**

Some students also described challenging relationships as barriers, such as discriminating teachers:

“And then eighth grade was just rough just because... they always hated my class moving up from the beginning... it was just a consistent thing... One of the teachers was
very much... a bully and she specifically had a thing against brunette girls who were smart.” -Beth

Here, Beth describes being a target of bullying from a teacher as a result of her appearance. This was one of a few separate mentions from Beth during our intake interview where she explained that she felt judged by others in academic settings because of the way she looks. In the next quote, Fiona explains her discomfort among peers as a result of feeling different from them:

“Sometimes I feel uncomfortable just because I was like, ‘Why aren't [my friends] with me?’ It felt different because I just felt-- sometimes I felt like an outsider because I'm just like, ‘All of these people are-- their parents help them a lot. They've gone to school and stuff.’ My parents, the highest that they went to was middle school, so yeah. So that was different.” -Fiona

In the next series of quotes, Helen describes receiving unhelpful support from family members and peers:

“And my mom is painfully positive. I love her but she's so positive and sometimes I need someone to be like, ‘Yeah, this test is going to be really hard…”

“I was hoping… to be paired up with someone who also was [like me]. It didn't work out… a lot of people, they're always like, 'Oh, that's so great.' But I can't even put into words how stressful it is. So it'd be nice to feel like I have a shoulder to lean on… it would be nice to have someone who could relate…”

"...I can go [to] my sister... But she always answers so clinically that it’s like-- it's not that it feels impersonal. But, I don't know. I feel like I could Google her responses.... I feel like it would be cool to have a more real-life friend that I can get advice from or maybe this group. Because we're all going through the same thing, college. So, that would be cool… I have a lot of the different points, encouragement, distraction, but I don't really have my real-life-- someone who's on the same level as me. So, I'm still looking for that.” -Helen

In these separate examples, Helen encapsulates a desire for relatedness and a sense of belonging.

Specific Event Challenges

A few challenges that emerged were quite distinct and particular to individual students. The code for challenging specific events was, not surprisingly, infrequently used. This made sense because the code was added after early stages of coding and rubric readjustments to
capture the aforementioned distinct events that were particularly difficult or damaging to students’ experiences but did not fit well enough into the other codes. For example, some students expressed concerns over campus safety and other challenges related to being a female:

“Walking... on-campus I'm fine but at the same time, I'm very cautious of everything because I know things had happened like there was a huge Facebook post that erupted last year about a girl who got sexually assaulted... and how nothing happened.” -Beth

“It's really intimidating especially a female going into STEM... usually, you see a lot of males going into that kind of stuff so it's scary just because you know, oh my gosh, it builds off of itself. So it's only going to get harder from here kind of thing. But yeah that’s-I feel like I've been able to do it so far so hopefully, I can continue.” -Fiona

Other events and experiences that fell into this code will not be shared in detail, as they contain sensitive and potentially identifiable information pertaining to a select few students. These events were depicted as traumatic and had significant impacts on students’ personal and academic lives. The impact of such an event, however, is presented anonymously in the following quote:

“To this day, I don't really understand it. I don't know if I ever-- I don't know if you can ever properly deal with something like so life-changing, especially at a young age. I've gone to counseling and I've done that. But I just don't, I don't know. I think my reality is things like that will happen. And it's okay. I'll make it through. But sometimes that's hard ... I feel broken.”

It cannot be ignored that traumatizing events in students’ lives have the ability to impact their academic lives in profound and prolonged ways.

In congruence with our theoretical lenses, challenges and important decisions were described as being significantly impactful on the students’ experiences in school. More commonly, challenges stemmed from within the students themselves. This fact alone supports a need for a space to unpack these inner struggles and work through them. Although not coded as a category within challenges, “decision points” impacting students’ decision to pursue their majors were probed because they aligned with the theoretical framing of this study (Baxter Magolda,
Discussion of this code can be found in Appendix I but was omitted from the results because it is beyond the scope of the research questions for this study.

Findings from the Peer Group

3. How do students describe their experiences in the group as a support or challenge?

The “supports” and “challenges” framework was applied to the focus group coding in congruence with the intake interviews, in an effort to capture the positive and negative experiences of the peer group. Students discussed their experiences far more often as a support mainly via relationships, although certain challenges were brought forth as well. Table 5 provides total occurrences and the number of students providing relevant quotes to each category.

Table 5

Summary of Focus Group Codes

<table>
<thead>
<tr>
<th>Theme</th>
<th>Subtheme</th>
<th>Definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supports</td>
<td>Relationships</td>
<td>Connections, relatedness, or shared identities among individuals or within the group as a whole (e.g. forming friendships or not feeling like the only one struggling) that participants describe as emotionally/psychologically helpful and/or as having had a positive impact on their academic and/or personal development</td>
<td>“I think I'm really enjoying being in an environment with a lot of intelligent people. It's almost kind of motivating. You guys are doing so well, and I'm like-- even if we're all struggling in some way in what we're trying to accomplish, it's really cool to see everyone trying their hardest in what they want to do.” – Christina</td>
</tr>
<tr>
<td></td>
<td>Group Content/Structure</td>
<td>Helpful or pleasant materials, activities, or structures of the peer group</td>
<td>“I really liked the days where it felt like the whole group was involved, like on the day where we did the show and tell and talent show thing. It's like we all had something to say or show, and it just felt like everyone was involved.” – Gia</td>
</tr>
</tbody>
</table>
|                | Internal/Self      | Reflections on one’s own identity or experiences (e.g. finding acceptance in past actions) that                                                                                                                                 | “I feel like I've become more self-reflective because I feel like sometimes we'll come (Continued on following page)
<table>
<thead>
<tr>
<th>Challenges</th>
<th>category</th>
<th>description</th>
<th>example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal/Self</td>
<td>Reflections on one’s own identity or intrapersonal experiences (e.g. negative opinions of one’s own work habits) that participants describe as emotionally/psychologically unhelpful and/or as having had a negative impact on their academic and/or personal development</td>
<td>“A challenge would be like, ‘You need to chill a bit. Let others speak.’ So, that alone was a challenge for me because I like to always elaborate on things and share more things about myself.” – Andre</td>
<td></td>
</tr>
<tr>
<td>Time Management</td>
<td>Planning and maintaining obligations with regards to time (e.g. fitting group meetings into schedules) that participants describe as emotionally/psychologically unhelpful and/or as having had a negative impact on their academic and/or personal development</td>
<td>“Well, when we got that sheet... I was just reading it, and I was like, ‘Oh my God. How am I going to fit this in with my schedule? ’ because it just seemed like a lot on paper.” - Nicholas</td>
<td></td>
</tr>
<tr>
<td>Social</td>
<td>Interpersonal feelings or experiences (e.g. awkwardness or difficulty speaking in front of others) that participants describe as emotionally/psychologically unhelpful and/or as having had a negative impact on their academic and/or personal development</td>
<td>“I would say, probably, initially, it was kind of awkward. So I would say it’s a pretty low point. No one knows each other so it’s just kind of weird at first.” – Dan</td>
<td></td>
</tr>
<tr>
<td>Group Content/Structure</td>
<td>Unhelpful or unpleasant materials or activities done in group (e.g. not connecting to activity such as reading poetry)</td>
<td>“I felt like when we did more poems and more relating it was very much some listening and some not... And it felt, like you said, a little forced.” – Beth</td>
<td></td>
</tr>
</tbody>
</table>
Table 6

Occurrences of “Support” Codes from Focus Group

<table>
<thead>
<tr>
<th>Supports</th>
<th>Total Counts</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relationships</td>
<td>46</td>
<td>10</td>
</tr>
<tr>
<td>Group content/structure</td>
<td>26</td>
<td>10</td>
</tr>
<tr>
<td>Internal</td>
<td>25</td>
<td>10</td>
</tr>
</tbody>
</table>

Note: “Total counts” refers to the total number of times a quote was categorized into each code. “Number of students” refers to the number of individual students who contributed at least one quote for each code.

**Relationship Supports**

The most common supports that students discussed were relationships. Given the social nature of the group, this was pleasantly not a surprise. Shared identity and relatedness as a result of relationships in the group were very common themes that emerged from students’ responses during the focus group. The feeling of normalizing struggle was especially salient:

“I kind of struggled with struggling [laughter]. Honestly, though, I struggled with feeling like I'm so alone, struggling in school and stuff like that. Even though doing pretty well, just hearing a bunch of other smart people saying they struggle with school as well, and they're going through hard times. It just makes it feel like you're not alone.” -Dan

“This semester was the hardest for me academically...It was definitely the most stressful and the most difficult classes I have taken. So just knowing that everyone else thinks these classes are difficult and it's not just me and it's not just me who has to stay up really late finishing an assignment. That relating was also really nice.” -Beth

“One of my fears coming to [current university] was I tried being at a university before and it didn't work out. And was that my fault? Was that my major's fault? I don't know. And I was at a community college and I did really well there. And so then when I was back in university the first month or so I was like, ‘Is everyone struggling as much as I am? Am I not able to go to a university?’ And so it was nice knowing that other people were struggling and this is just what school is [laughter].” -Shelby

“I think I'm really enjoying being in an environment with a lot of intelligent people. It's almost kind of motivating. You guys are doing so well, and I'm like-- even if we're all struggling in some way in what we're trying to accomplish, it's really cool to see everyone trying their hardest in what they want to do. And it's just a very motivating environment to me, I think.” -Christina
“So I definitely feel more positive, leaving a group... [I] know that someone's sharing the same anxiety as I am.” -Andre

Students also described more general support from one another such as familiarity around campus, enjoying each other’s company, and encouraging positive habits:

“I'd say it's always a good time. We're always laughing. That's not on the description sheet I'm sure. We're having a good time at the same time, getting to know each other, and being supportive, so I would tell them that.” -Nicholas

Next, Shelby shared the positive impact of having new connections on campus as a new transfer student:

“Going off that a little bit, the first couple weeks, it was nice to have familiar faces around campus… people who we didn't know… very well… that was kind of cool because I'm not from around here. And I transferred into this school and I didn't know anybody here. I've made like two other friends outside of this group… it's cool having people that I know around campus.” -Shelby

Helen built off of this:

“I agree. I feel like the supportive smile-nods that we all give each other in the hall-- It's not like, ‘Oh, hey. Love you,’ but it's like... [laughter] it’s nice... you're going through your day. And I'm like, ‘I don't have many friends here, either.’ So I look up. I'll see someone and I can interact with, a human, that'll be great.” -Helen

My near-peer mentor role in the group also constituted a supportive relationship, in that some students appreciated my openness and laid-back nature of leading the group:

“So, I'd say, just in general, it's definitely very hard in this university to find someone like Erika because you go to a teacher and they're rushing to their time or their class or the TA, they have their own grad school work. It's definitely nice to have someone that's has time to, as well, kind of chill with us and it's definitely impacted as well.” -Andre

Dan reacted to this with, "Second that.” Helen and Fiona had thoughts on my role in the group as well:

Helen: “I just want to say, Erika, you've been really great and I think everyone agrees. And I don't think the group would've gone as smoothly as it would have if it was someone else, so thank you.” [applause]
Fiona: “…I like the fact that you talk about your own experiences too… it makes me feel like you're… not just someone that's looking over us, but you kind of are able to open up to us too. It's nice.”
Helen: “You're like one of the homies.”

**Group Content/Structural Supports**

Beyond learning about each other’s lives and promoting positive behavior, other activities and structures of the group were described as helpful and enjoyable to students and often facilitated especially meaningful conversations. Students also frequently commented on the casual and open structure of the group—a far cry from their usual STEM settings, so they stated:

“I guess another way it's changed from the beginning, this group, besides making all the friends, in the beginning it felt kind of like a chore. And I'm going off of some other people here. Now it's kind of, [I] look forward to it. We always laugh, I think it's [a] pretty good time so it definitely doesn't feel like a chore anymore, like a class, like it did. The first couple meetings it's like, ‘Oh. It's Wednesday night, I gotta go... do this thing.’ I definitely look forward to it now.” - Nicholas

“I think, when you see STEM attached to anything, you're always like, "Okay, so I guess I have to go buy a lab coat." [Laughter] And you're like - I don't know - "I don't know what this is.” I didn't really know what to expect. But I guess I was expecting that we were going to be doing STEM stuff. But instead, it was the thing that we had in common. So then, we could just kind of put that aside and do other stuff together, I guess?" - Shelby

She elaborated on this point towards the end of the focus group, and then Helen added on:

Shelby: “But I would really emphasize that this isn't a burden of any sort. This isn't like a mountain to climb... I feel like some majors are always out there looking for some challenge and whatnot and this really is just a chill place to get help and to talk and to figure stuff out. And this isn't a thing to take on, it's really just very chill.”

Helen: “Yeah. I agree with that. I'm joking, no offense you guys, I call it my nerd group [laughter]… it's not a burden and it's not... typical STEM, like, ‘You have to be so smart,’ or like science oozing out of you [laughter]. No, it's just chill.”

Although admittedly one of my own personal worries from the onset of the peer group was that students would view the group as a burden, it was refreshing to hear the very opposite opinions
from a few of them. They expressed many positives from the peer group, from their connections to the overall vibe of the group itself to individual sessions.

Interactive activities that elicited particularly deep and personal stories were commonly discussed and praised for their impacts on students’ perspectives of themselves and each other:

“I really liked when we did that activity with the pictures on the floor. So we just kind of thought of our feet, the first thing that came to mind, so we could just kind of get to know everybody a little bit more.” -Fiona

In the quote below, I will provide an excerpt from my reflective journaling after Session 4 to triangulate and support Fiona’s previous feedback:

It was great. The moments where I can see lots of group reactions are the most memorable for me. I love seeing everyone sharing in the emotion and experience. Especially laughter. And the curiosity about one another. I am glad I pushed that today, because it seemed to be really effective. -Reflection 4

In the next quote, I will provide an excerpt from Reflection 9 to describe a specific activity that students found particularly impactful:

Wow, where to start? Today, we made magic... I explained that the album “Strange Trails” by Lord Huron had a huge impact on my life and I wanted to share the themes with them as a discussion topic. I told them about some of my own “strange trails,” then we listened to the song “Way Out There” while looking over the lyrics... We talked about lines that stuck out to people. Dan brought up the line “I’ve been running through life and cruising towards death.” He said that he wonders what all this school is for sometimes. Someone asked me if getting out of school/getting a job made things easier. I shared that it didn’t, and arguably I felt more depressed, anxious, and low when I had my highest paying job... Andre connected to this by agreeing that a job and whatnot isn’t everything... Others reacted to the lyrics, then I passed out another handout that specifically asked the students to think about their own “strange trails.” This yielded an amazing conversation. Nicholas shared that he is ashamed of some of his trails, but that he is happy they have taken him where he is. Dan shared that he feels like he hasn’t gone down a lot of strange trails for fear of failure, but wants to go down more. -Reflection 9

Students brought up this activity more than any other group content during the focus group, and explained various perspectives and positive experiences that resulted from our conversation:

“The ‘Strange Trails’ conversation, I feel like that kind of just helped see where people are coming from and where they came from. It’s interesting. Everyone has a story.... I
remember... it kind of helps you learn a little bit more about the people in the group, more about them personally, and maybe explains why they are who they are, why they like what they like.” -Dan

“I feel like a common thing that happened during those [‘Strange Trails’] conversations was that we found relatability between... each other. I guess that's really it.” -Andre

“...It's the journey that we need to be focusing on. That's why the ‘Strange Trails’ is so lovely.” -Andre

Fiona and Sonia both describe this activity as one that prompted them to have meaningful self-reflection, even outside of the realm of the weekly meetings:

“When we did the ‘Strange Trails’…it just made you reflect on their weird paths [you’ve] taken. It was definitely something I reflected on after.” -Fiona

“I was thinking the ‘Strange Trails’ thing too. When you asked us to write down our strange trails, I was like, ‘I don't know.’ I've never sat and thought about that before.” -Sonia

Clearly, “Strange Trails” made an impact. This is a particularly special finding, as I reflect on this effort as both deeply personal to me and also a very successful endeavor for the group.

I further reflected on my own feelings about this particular session, calling out my own bias as well as feeling a sense of pride in observing the group’s development as a supportive community:

I also realize that I had biases about the students after interviewing them, thinking that because they’re all such go-getters that maybe they don’t actually need this structured social support. I realized tonight how valuable this is, at least for a few individuals in particular... Amazing work done by the students tonight. I’m feeling so proud of [them] for the vulnerability and effort they are putting [in] to group... It makes me feel proud of myself too, in that I have been really trying to make this an authentic and productive time for growth and reflection, and it’s happening... It makes me feel so happy to hear that our goals for this group are actually being accomplished. -Reflection 9

Challenges from the Peer Group

Although students were overall mostly positive in their remarks about the peer group, students had a number of items that they described as challenging. Table 7 summarizes the
occurrences of codes related to challenges of the group that students described during the focus group.

Table 7

Occurrences of “Challenges” Codes from Focus Group

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Total Counts</th>
<th>Number of students</th>
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<tbody>
<tr>
<td>Internal/Self</td>
<td>30</td>
<td>9</td>
</tr>
<tr>
<td>Time Management</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Social</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Group content</td>
<td>5</td>
<td>4</td>
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Note: “Total counts” refers to the total number of times when a quote was categorized into each code. “Number of students” refers to the number of individual students who contributed at least one quote for each code.

**Internal Challenges**

Some students expressed inner struggles such as having to share in front of others (or simply their distaste for having to do so):

“Sometimes it's kind of like, I don't really want to show up. I have too much other stuff going on. I want to sleep. So a bunch of stuff just kind of hits you at once, and you gotta go talk about your feelings for a couple of hours. Not my favorite thing to do.”

-Harold

“Well, for me, sometimes I just don't feel like talking. It's not anything against the group or anything, but sometimes I get here and I feel like-- I just don't feel like sharing in front of everybody. And then I feel bad because I don't want people to think, ‘Oh, she's like so disengaged,’ or anything. Sometimes, I just don't feel like talking. So that was like-- that happened a few times this semester.”

-Sonia

After hearing Sonia say this, my observations recorded in a few group meetings made more sense. While subtle, I noticed that she did not always look very happy in group, as described in the following excerpts from my reflections:

Are there any group members I am concerned about for any reason at all? Possibly Sonia? She just looked a little bit unhappy at a few points, but I also may have been misreading her body language/expressions. -Reflection 1
Time Management Challenges

Time management was also discussed as a significant hurdle related to the peer group and was subsequently created as a distinct challenge code. Given the students’ high course loads and the subsequent difficulties associated with scheduling a time for all of us to meet each week, this was not a surprising result.

“…That was hard for me was on Wednesdays, I wasn't planning on having this and then a review session right after. So I would have class, and then I would have to go to another class, and then I'd have to run here and run to a review session every week that I was not initially aware of. And that sometimes there were days where I was just like, ‘I have no time, I'm tired, all I want to do is eat food.’ So that was a struggle for me… the scheduling.” -Beth

"For me, Wednesdays are my longest days of the week for sure. So then after this, I have a study group as well. So it's like I'm on campus for more than 12 hours on Wednesdays and then I work half of the day… So, I finally get a time to relax here when I get to sit down so I'm just kind of like, ‘I need to just listen.’” -Fiona

“I guess for me in terms of time management, it's not more of like an all-day thing. For me, it's kind of like certain periods of time where it's like just a bunch of activities happening so sometimes I have class and there's at the same time as an activity or a fundraiser going on that I would like to support and I got to choose either go to class, or maybe get a little bit late to class to go do that. So the same thing just applies to this group.” -Andre

Social Challenges

Getting over the hurdle of awkwardness was the presented as a challenge in terms of the overall group dynamic:

“I guess it's challenging to get over the fear to be the first one talking because either we're all going to sit here in silence for an hour and a half, or I'm going to be the awkward one who talks first, and usually it was that. So I guess that was something of a challenge.” -Helen

“I would say, probably, initially, it was kind of awkward. So I would say it's a pretty low point. No one knows each other so it's just kind of weird at first, but warmed up pretty well, I guess I'd say.” -Dan
A challenge that impacted approximately a third of the group was not having another student in their major in the group:

Pascal: “This is not realistic, but I hope there would’ve been one student also from [my major]. Seems like I’m the only one here.”

Nicholas: “Yeah. I can relate to that [laughter]. I was hoping somebody else was [in my major], and then we could do homework or whatnot.”

Christina: “I can also relate.”

While students were able to relate to one another based on being in STEM in general, there were certain aspects of individual majors that were unique and non relatable to students with different academic paths.

**Group Content/Structural Challenges**

Although students enjoyed some of the activities and structures of the group, not all were seen as useful or enjoyable. Gia, for example, had strong feelings about reading poetry:

“Some of the lowest points… was reading poems and stuff and trying to relate to them, certain lines, to our lives. I personally hated it. It felt like English class to me. Even though I know it was a way for us to get to know each other and how these lines might have related to us individually, but it just felt so forced. And it’s just not something that I really liked to talk about or think about, especially when it's supposed to be a more relaxed kind of group. No offense to anyone.” -Gia

When asked if others agreed, a few spoke up:

“I wasn't the biggest fan of [the poetry]. I liked some of the other things we did better, like that red light, green light we did. I thought that was cool. Same with the birthday one where we were blindfolded. I definitely liked more interactive activities like that.” –Nicholas

“I felt like when we did more poems and more relating it was very much some listening and some not. And someone else saying something. And it felt… a little forced. I definitely liked the more interactive things because I felt like that's when… it became more of a conversation rather than someone saying something and then someone else saying something. It was a back-and-forth and I liked that a lot more.” -Beth
Results from coding the collective experiences via the focus group generally mirrored the findings from the individual intake interviews; supports were more commonly discussed than challenges, and students’ relationships to one another and to themselves proved to be most salient. Many of the supports described were addressing relatability regarding the challenges of being STEM, as well as the development of an overall comfortable and supportive group of students. While some students faced challenges such as simply making it to the group or participating in particular activities, the students’ descriptions of their experiences in the peer group were overall highly positive.

4. What do participants describe as significant impacts from the group?

In this section, significant impacts from the group will be discussed. “Significant impacts” are defined as overall common themes that were most salient from the focus group interview and includes impacts that affected the students outside of the group itself. These impacts are distinct from “supports” as described in the previous section in that they are presented as more general takeaways and shared experiences by the students in the group. In contrast, supports from the group were presented more broadly as positive experiences rather than experiences that were described to have more lasting effects on the students’ lives. The themes presented in this section mainly represent students’ responses to the following two questions from the focus group interview guide (Appendix G): “In what ways has this group affected you beyond the group itself?” and “What is one way you see yourself differently now than you did at the beginning of the semester?” Students were most vocal about getting to know one another, relating to the challenges of being in STEM, and having a relaxed environment in which to do it. Normalizing the struggles of being in STEM was very often referenced as useful in the context of the group because it allowed them to feel a shared identity that others in their
lives did not understand. In the following two quotes, Fiona and Christina build off of one another:

Fiona: “I feel like simply knowing that there's a group of people that are all STEM majors-- because all of my friends are HDFS and all that stuff. So knowing that there's people that are actually striving for STEM - because it's a hard field - it's nice. It's good.”

Christina: "Yeah, I think that's also really true. Because some of my friends just-- they don't understand the kind of workload that I have, and that sometimes I can't hang out with them because I have math to do or science to study for. And it's really nice to know that other people feel the same way. You have to prioritize your schoolwork sometimes. It's kind of hard to relate that to friends who don't have the same kind of workload as you.”

Others found it useful having fellow students in the same major, finding comfort in their shared identity. Andre described the benefits of getting to know fellow classmates who were in the group:

“I guess for those of us that have the same majors in the room... It's supportive that-- maybe we're taking the same class or it's a class that we've taken before-- it's that supportive nature, where it's like, ‘Oh, you've got this,’ or, ‘That exam was pretty rough.’ And I found that similarity between some of you that's in the same major with me.” - Andre

Next, Beth expanded on this idea and further explains positive psychological benefits:

“I'm one of the [biology] majors. So there's quite a few of us that are in [biology], and some of us are in the same lab and classes. And just knowing I can ask people if I have a question and I know they'll help me out, or even-- I have a tendency to get test anxiety. So knowing other people are panicking makes me feel normal. So before analytical I'm like, ‘Hey, you guys. Are you guys panicking too?’ And everyone's like, ‘Yes. And I'm like, ‘Okay, I feel better.’” -Beth

The formation of trust and connections among students was evident in their words as well as their banter during the focus group:

“I guess meeting all you guys was kind of the high point.” -Harold

“Oh, this semester was... not hardest school-wise but just-- a lot of... different transitions that happened in my life this semester, so it was just hard to go day-by-day, but Wednesdays I always look forward to because I always have a group that seemed to care what I say and stuff.” -Dan
“I think the most supportive part, for me, is just being able to come in here and know that you're not going to get judged or anything. And a lot of what you guys said-- other people are going through the same thing as you. And so you're not the only one.” -Nicholas

In the next quote, Harold and Helen call attention to the safe and supportive nature of the group:

Harold: I don't really feel judgment in this room from any of you guys.”

Helen: And if there is, you're doing a good job of hiding it, [laughter].” -Helen

In another playful exchange, Dan and Andre talk about growing more comfortable in the group:

Dan: “I guess it's kind of testing the waters a little bit. Each day, you maybe say something a little bit more, walking the plank a little bit. Each day is a little bit like a step. And then, coming next means a little bit further. And then, you look back... and you're on the edge, you know?”

Andre: “That was deep, [laughter].”

Dan: "I'm about to jump in, you know?"

Conversations that occurred within the peer group were also described as impactful, especially once the group had pushed past its more “awkward” phase of unfamiliarity. A few students recalled a particularly meaningful quote from Helen earlier in the semester and related it to their lives, connecting to one another’s experiences:

Andre: “I like how you phrased it one time at one of these sessions where [Helen] said, ‘Oh. I can come here and do all things and as long as I go home.’ You have someone that looks up to you as a hero. So that just stuck because although I might not have a son or daughter, I know eventually coming home there's someone that looks up to you, who finds you inspiring.”

Dan: “I think that quote that [Andre] said... that put a lot of things in perspective too because, yeah, at the end of the day your family and friends still care about you and it doesn't matter if you got a C on a test or whatever, you're still cared about in some way. It doesn't define me.”

Fiona: "I actually thought about that yesterday [laughter]. It's really funny that everyone's saying the same thing. I turned in a sixteen-page paper and we did this huge presentation in class. I don't know, I turned it in, it was due at midnight, so I turned it in at 11:57 or something [laughter]. So it's just like, ‘Okay. I'm done.’ And then, I'm just like, ‘At least... I have someone who cares about me.’ It's like what you said.”
Other members discussed individual connections as well. Shelby and Christina formed a friendship and study partnership outside of the class and often referenced it both during weekly meetings and in the focus group:

“To kind of go on that too, just even if it's not just the same major, but having similar classes with people in here has been super supportive. Being able to build a friendship with Shelby with our math classes together and then working sometimes with you in chemistry-- it's just really nice to know that if we're in the same classes together, we can go to each other if we need help for whatever reason. I feel pretty comfortable going to anyone in here if I needed help with something.” -Shelby

“I think being able to work on math with Shelby, because I spent all of last year not knowing anyone in my math classes and I just had to struggle through them on my own. I was able to do the math because I liked it, but this semester when I got into this math class I was like, ‘There is no way I can struggle through this one on my own.’ I feel like if I had to have done that all by myself I would have had way more moments of panic, and I already did have enough as it is. So being able to work on homework because I found a friend through this group who also has the same class as me, made it so much easier and I'm just really happy that I was able to make it through this class with someone else.” -Christina

Shelby responded to Christina:

“Yeah. I think without you I would be struggling to pass this class right now and instead I'm like, ‘I might get an A in linear algebra.’ That's whack! Weird. So I definitely agree with that.” -Shelby

Next, I provide my own view of this relationship. I remember feeling happy to hear this during our sixth weekly meeting and was sure to document this success:

Shelby and Christina shared about their new formed friendship and study habits... Shelby was vulnerable in declaring the friendship and pointedly beginning a discussion.

-Reflection 6

Other support from relationships in the group came in the form of encouragement for both academic and nonacademic pursuits, thereby encouraging positive habits as well as more broadly impactful efforts such as activism. Students shared and learned about one another in different contexts other than STEM, even delivering inspiration to promote positive change in the world:
“I think when I shared everything that's happening at the pool that I’ve been trying to work towards, it was really nice to be able to talk to you guys about it. And that you guys... were supportive of what I was doing... It felt nice... just being able to share that with you guys, and that you were like, ‘Oh, I hope that works out for you.’ Yeah. It was just nice to be able to talk about it.” -Christina

“So when [Christina] shared her story about the pool, it kind of inspired me... My friends aren't really worrying about [climate change], and they don't recycle and stuff. Up until then, I was just ignoring them because I didn't think I would change their mind. But then she gave me hope. If it works, then good. If it doesn't, then it's not going to work anyways. It's not going to really change anything, but at least you can try. So far I've convinced ten of my friends to convince their family to recycle more.” -Pascal

Next, a few students described promoting hobbies such as reading outside of the group:

“…We were talking about how a lot of us used to read all the time and never read anymore, going for walks and stuff like that-- I thought that was really cool as a group that we kind of silently made a pact to start doing these things again. And then the next week, everybody was like, ‘Oh, yeah. I've been reading before bed. And I've been taking walks.’...We're actually helping each other outside of this room.” -Shelby

“…When we were talking about books, and how everyone had not been catching up to their reading like they used to… Took a week or two but I definitely went and revisited The Outsiders. So that was something nice, to just sit down and read… it was something that affected me in a nice way.” -Andre

“I guess kind of learning about all your guys’ different hobbies, kind of made me want to go out and do more things, new things, different fun things.” -Harold

In addition to forming connections and feeling supported by peers, students described positive outcomes in terms of the way that they now view themselves after being in the group. Some students described newfound feelings of confidence or inner growth:

“So in the middle of this semester, before I was applying for my internship, I attended the open house and then I was feeling very under-qualified because I can't communicate as well as the other people. And then I shared that here and then he said, ‘I'm taking 18 credit hours and I'm also working part-time. I should be very more qualified than a lot of people here.’ And that just gave me a lot of confidence. I felt very supported.” -Pascal

“One thing I notice is I feel like being able to talk to more-- or not talk, but say ‘Hi’ to random people more often. Say 'Thank you' or-- I don't know. I used to be kind of introverted a little bit, don't like new conversations with people but, I don't know, just being able to talk to more people, more easily because of this group, I would say. -Dan
Next, I use my observations from my reflection to highlight a meaningful exchange between Dan, Shelby, and Beth:

It was also memorable when Shelby and Beth shared about their parents’ expectations. Dan reacted to this by saying he couldn’t believe that anyone would be disappointed in them because they are smart and kind people. It was so sweet. -Reflection 9

Shelby described the same interaction in the next quote:

“I think I've gotten a lot more confident in myself academically, I guess, since the beginning of the semester. Like I said when I came here, I was a little bit worried that it was going to be too much for me. And it was two meetings ago, or maybe three-- I don't remember, but Dan said something. I don't even know if you knew how important it was for me at the time, but you were like, ‘I don't know how you guys can believe people telling you that you're doing the wrong thing, when I see you guys and you're doing such a great job.’ And that really stuck with me, and was really important to me.” -Shelby

“Strange Trails” came back again when Helen described the impact that the group has had on her:

“We are here, and kind of like this ‘Strange Trails’ type of thing... It doesn't always go the way you want it to, but it is what it is and we're here and I guess this group has just helped me outside here just be more okay with who I am and that yes, I'm older than most people in my grade and I'm many years behind and whatever it is. That's how used to think of it, but now I'm like, ‘I'm here despite X, Y, and Z,’ and I really think that this group has helped me because I've gotten to express the struggles that I have and stuff. And then you guys have been supportive, and other than that I'm just struggling on my own, so thanks.” -Helen

Reflecting back on Helen’s intake interview, she described wanting a “shoulder to lean on” and “someone who could relate.” Contrasting this with the above quote, it’s safe to say that she was able to find what she was looking for. Overall, the peer group was truly a success and a moving experience for the students and for me as a leader. Students described meaningful relationships that were supportive in their academic and personal lives, thereby making a positive impact in their journeys through persisting in STEM. Students also highlighted healthy habits, hobbies, and perspectives that resulted from encouraging each other as part of the group, suggesting that the experience yielded benefits both during and outside of our time together. These findings strongly
support theoretical and empirical lenses that suggest the importance of social integration (Bandura, 1986; Tinto, 1975) and a sense of belonging (Maslow, 1970; Zaniewski & Reinholz, 2016).
CHAPTER 5. CONCLUSIONS

Overview of Findings

1. What sources of support do students commonly reference prior to the program?

An internal drive to succeed was very apparent from my individual conversations with all of the students during the intake interviews. This was the most prevalent finding regarding meaningful supports. Students also frequently discussed previous supports stemming from positive relationships within school (e.g., teachers and peers) and outside of school (e.g., family and friends). Academic supports were mainly described in terms of scholarships and research opportunities. Students more commonly referred to instructors as distinctly supportive (or unsupportive) relationships and were coded as such, despite the academic setting where these relationships were generally taking place.

2. What challenges do students commonly reference prior to the program?

Prior to the BELONG in STEM Scholarship Program and engaging in the weekly peer group meetings, most challenges were framed in terms of STEM-specific struggles such as a very high workload or difficult courses. Some students experienced negative relationships or environments (e.g., interactions with instructors); others explicitly stated a desire for someone who could better relate to their challenges in STEM.

3. How do students describe their experiences in the group as a support or challenge?

Students generally described the peer group experience as very supportive, mainly via positive relationships and finding relatability with one another. They also found certain content,
such as the “Strange Trails” conversation, to be particularly useful in learning about each other’s past experiences and journeys through college and beyond. Although less prevalent, some students described challenges in the group related to time management, unpleasant content, and a lack of desire to share in the group setting.

4. What do participants describe as significant impacts from the group?

Experiencing shared identities, especially normalizing the struggles of STEM, was described as very impactful by many students during the focus group. They also described forming distinct friendships, study partners, and an overall comfortable and supportive community that was unlike other academic settings they had experienced previously. Students’ sense of self, such as their science identities and self-efficacy, were also indicated to be positively impacted as a result of being in the group.

As predicted, students came into the BELONG in STEM program with a variety of supports and challenges that impacted their abilities to persist. Factors were complex and often interwoven, such as the push and pull of self-regulation and familial support. Oftentimes when a student discussed feeling internal discourse or external influences, he or she was in fact changed for the better as a result of persevering. This clearly demonstrates Bandura’s claims that resiliency of one’s self-efficacy is extremely important in student development (Bandura, 1986).

It was also clear that it was more often the connections with others that made a difference versus just academic structures themselves, relating to Tinto’s Theory of Departure (1975) in that relationships have important implications in a student’s quest to persist to the end of his or her degree. For example, being specifically sought out to participate in research by a professor versus simply applying for a research position was highlighted as a motivating and highly supportive experience that also promoted a more defined science identity. Friends, peers, family,
and instructors were at the heart of many stories that students shared, both good and bad. A particular emergent theme was the importance of family, as all students shared at least a brief mention of being supported by parents and/or siblings. This claim is supported by previous literature that highlights the relevance of such connections in student success (Buchmann & Diprete, 2006; Burge, 2013; Dimitra, 2013). Tinto’s theory (1975) was also supported based on the results of the focus group, in that students described feeling supported and positively impacted as a result of forming relationships in the peer group.

Many students expressed during our individual interviews that they were seeking different support than what they had been getting so far. Some distinctly stated that they were looking for people who could relate to them. In this way, students described a lack of a sense of belonging. This fit extremely well with the opinions and stories shared during the focus group interview in that after one semester of attending the weekly meetings, students described developing a strong sense of belonging and shared identities.

As a near-peer mentor and leader of the group, my goal was to foster a supportive environment where the students could develop a sense of belonging and relate to one another, addressing personal and academic concerns in an effort to promote persistence (Tinto, 1975). Given students’ feedback via results from the focus group, this objective was clearly met. The group was intended to be a social setting where students could talk about things that they otherwise might not have a space for in their STEM education, thus cultivating social dimensions of science identity. As shown from the voices of the students and echoed in researcher reflections, there was a definitive development of the group as a community from the beginning to the end of the semester. After pushing through the awkwardness, we reached a zone of trust and comfort where students were able to support one another, find shared identities, and form
meaningful friendships. Activities such as discussing our “strange trails” proved to be especially instrumental in accomplishing the goals of the group, allowing students the freedom to share about themselves in an environment devoid of judgment and other constraints found in traditional academic settings. Additionally, such conversations promoted meaningful reflections by students on their own individual journeys. In this way, Baxter Magolda’s Self-Authorship Theory (2004) proved to be a useful framing for this work in that students were impacted from an opportunity to develop often a more accepting, stronger sense of self and the ability to see themselves as the authors of their own lives.

Limitations

Given the researcher’s positioning and programmatic implications of the peer group, there are limitations to this study. As discussed earlier, my position in the group presented a power differential that could have influenced the students’ level of comfort or willingness to disclose their honest opinions about the group. However, open-ended survey answers provided by the external evaluator for this project confirm that the students’ only concerns with the group centered on time management and not with pressure to perform for their peer group leader. It is also significant to note that attendance of the peer group was a mandatory component of the scholarship program. Furthermore, not all members chose or felt comfortable to regularly share thoughts, emotions, or opinions. Not surprisingly, students who tended to be on the shyer side during weekly meetings also were less active in the focus group conversation. It was impossible to prevent this and simultaneously maintain a comfortable and low-pressure environment. One of the main tenets of the group was that students did not have to share if they didn’t want to. Forcing more quiet students to speak would not have been an appropriate course of action as the leader of the group. Therefore, although this limitation was unavoidable, it is nonetheless a
shortcoming of this study in that it was not possible to present an entirely balanced amount of viewpoints from all students for each research question. Another limitation was the fact that the students’ words themselves can only be taken at face value. In other words, it is possible that students faced other challenges or dislikes related to their educational experiences and/or the peer group and chose not to disclose them for whatever reason, such as not wanting to offend me as the group leader.

Additionally, given the prestige of the scholarship program (required >3.0 GPA, letters of recommendation, outstanding personal statement), the stories told from this case study are representative of the upper echelon of STEM students despite their financial limitations. Many students who struggle to persist fall outside of these bounds. It is important to recognize that these students have their own stories, their own supports and challenges that are undoubtedly unique among the BELONG in STEM scholars. Therefore, future research would benefit from pursuing a similar effort geared towards lower academically achieving students in order to gain a broader qualitative understanding of persistence in STEM across student backgrounds and skill levels.

Implications for Educators

This group is by no means presented as the only way to facilitate peer support and a sense of belonging among STEM students; it is but one attempt to make a difference, with largely positive results. Although not an exhaustive list, educators can take away a few main points from this study:

1. Recognize that STEM scholars of all backgrounds have stories beyond just being students in your classroom; their personal lives are filled with stories that add context to their
abilities and actions in the classroom. Asking questions and showing an interest to know their stories can make a significant impact.

2. STEM undergraduate students can benefit from casual, low-stakes social settings. Given the many high-pressure situations that students find themselves in as a result of being in STEM, students report that having a distinct space for support and reflection can be positive for their academic and personal growth.

3. Graduate students can act as near-peer mentors and are useful instruments with which to facilitate sense of belonging among undergraduates. Given a (typically) smaller age gap and more recent shared experiences, college students can benefit from positive relationships with graduate students—even from different STEM disciplines. Not all graduate students may have a desire or be equipped for such a role, however. Qualities that would be ideal for willing graduate students include strong leadership and interpersonal skills as well as a level of comfort with discussion of social/emotional aspects of students’ lives.

4. Normalizing the struggles of being in STEM can be done at various levels; positive modeling and conversation around the nature of persevering through obstacles and “strange trails” can be accomplished by instructors and mentors, thereby reminding students that they are not alone or incapable because they struggle.

**Implications for Students**

Some students can benefit from seeking out or embracing alternative spaces in college to reflect and connect with others, as well as simply finding ways to acknowledge shared identities among peers. Social support can occur outside of a structured NSF-funded program, even if for some it may require challenging emotional efforts. As the BELONG in STEM scholars have
shown, it requires a strong internal drive to persist in STEM. Bandura would certainly agree, as he once stated, “It takes a resilient sense of efficacy to override the numerous dissuading impediments to significant accomplishments,” (Bandura, 1999, p. 5). Navigating the strange trails and barriers of being a STEM major appears to be far more palatable for some students with support from peers and near peers who can relate and promote a deepened sense of belonging in college.


APPENDIX A
IRB APPROVAL FORM
Approval Notice
Continuing Review

25-Jun-2019
Nicole LaDue
Geology and Environmental Geosciences

RE: Protocol # HS18-0183 “The impact of the Belong in STEM Scholars Program”

Dear Nicole LaDue,

Your Continuing Review submission was reviewed and approved under Expedited procedures by Institutional Review Board #1 on 25-Jun-2019. Please note the following information about your approved research protocol:


Please remember to use your protocol number (HS18-0183) on any documents or correspondence with the IRB concerning your research protocol.

If you are still recruiting subjects and have not waived the written signature of consent, I have attached a date-stamped copy of the approved consent form for your use. NIU policy requires that informed consent documents given to subjects participating in non-exempt research bear the approval stamp of the NIU IRB. This stamped document is the only consent form that may be photocopied for distribution to study participants. If your project will continue beyond that date, or if you intend to make modifications to the study, you will need additional approval and should contact the Office of Research Compliance, Integrity, and Safety for assistance. Continuing review of the project, conducted at least annually, will be necessary until you no longer retain any identifiers that could link the subjects to the data collected.

It is important for you to note that as a research investigator involved with human subjects, you are responsible for ensuring that this project has current IRB approval at all times, and for retaining the signed consent forms obtained from your subjects in a secure place for a minimum of three years after the study is concluded. If consent to participate is being given by proxy (guardian, etc.), it is your responsibility to document the authority of that person to consent for the subject. In addition, you are required to promptly report to the IRB any injuries or other unanticipated problems involving risks to subjects and others. Please accept my best wishes for success in your research endeavors. If you have any questions or need further help, please contact the Office of Research Compliance, Integrity, and Safety at (815) 753-8588.
APPENDIX B
CONSENT FORM FOR STUDY
Title: The Impact of the Belong in STEM Scholars Program

Investigators: Dr. Nicole LaDue & Erika Zocher, GEOL, 815-753-7935
Dr. Daryl Dugas, LEPF, 815-753-8467

Key Information
- This is a voluntary research study on the impact of the Belong in STEM Scholars Program.
- This multi-semester study involves participation in a social support group, interview(s), and focus group(s).
- The benefits include understanding factors that influence STEM students’ persistence in their education and a detailed account of student experience in a social support group. There are minimal risks and include discomfort associated with disclosing personal information and negative experiences regarding participation in the program. Additionally, there are slight informational risks related to internet security and data storage.

Description of the Study
The overall purpose of the study is to understand what factors influence undergraduate STEM students’ decisions to persist in their major. Additionally, the purpose of this study is to provide a rich description of students’ experiences in a social support group for STEM scholars.

If you agree to be in this study, you will be asked to do the following things: complete an individual interview (approximately 1.5 hours), attend a weekly social support group (each lasting 1.5 hours), and participate in a focus group (approximately 2 hours).

Risks and Benefits
There are minimal foreseeable risks associated with this project. The main risk involves discomfort when discussing personal and negative topics while participating in the social support group. Additionally, participants may experience discomfort as a result of content disclosed by other group members.

There is limited chance for informational risk related to internet security and data storage. This includes the risk that the third party survey vendor may not securely maintain data. However, this risk is no more significant than in daily life. Precautions will be taken to minimize this risk by labeling all data files with pseudonyms and storing the key in paper form in a locked file cabinet.

The benefits of participation for the individuals are social/emotional support from peers and mentors, increased awareness of campus resources, and a sense of community among STEM students from different content areas. Further benefits will extend to the broader scientific and educational communities through a deepened awareness and understanding of student experience in STEM. Furthermore, future educators and students can benefit from applying similar strategies to providing social support.

Confidentiality
The records of this study will be kept strictly confidential. Research records will be kept in a locked file, and all electronic information will be coded using pseudonyms and secured using a password protected file. Audio recordings will be accessible to researchers on the grant (Erika Zocher, Dr. Nicole LaDue, and Dr. Daryl Dugas). These recordings will be used for qualitative research purposes and will be kept for the duration of the five-year grant. After this time, they will be erased. We will not include any information in any report we may publish that would make it possible to identify you.

It should be understood that, when participating in a focus group, confidentiality among the members of the group cannot be guaranteed.

Compensation
You will receive the following compensation for your time:
- $20 for intake interview (approximately 1.5 hours)
- $30 for focus group (approximately 2 hours)

Your Rights
The decision to participate in this study is entirely up to you. You may refuse to take part in the study at any time. You have the right to skip any question or research activity, as well as to withdraw completely from participation at any point during the process. Your scholarship for the Belong in STEM Scholars Program is not contingent upon consenting to participate in this study.

You have the right to ask questions about this research study and to have those questions answered before, during, or after the research. If you have any further questions about the study at any time, feel free to contact the researcher, Erika Zocher at ezocher@niu.edu or by telephone at 203-889-6167. Alternatively, you may contact Dr. Nicole LaDue at nladue@niu.edu or 815-753-7935.

If you have any questions about your rights as a research participant that have not been answered by the investigators or if you have any problems or concerns that occur as a result of your participation, you may contact the Office of Research Compliance, Integrity, and Safety at (815)753-8588.

Future Use of the Research Data
After removing all identifying information from your data, the information could be used for future research studies or distributed to another investigator for future research studies without additional informed consent from you.

Your signature below indicates that you have decided to volunteer as a research participant for this study, and that you have read and understood the information provided above. You will be given a signed and dated copy of this form to keep, along with any other printed materials deemed necessary by the study investigators.

Participant’s Signature ___________________________ Date ________
I give my consent to be audio recorded during the intake interview and focus group.

________________________________________________  ________________
Participant’s Signature                              Date
APPENDIX C
SEMI-STRUCTURED INTERVIEW GUIDE FOR INTAKE INTERVIEWS
INTerview Guide – BeLong in STEM

1. Tell me about where you grew up.
   a. What was it like being in school there?
   b. What was a high point in school?
   c. What was a low point in school?

2. Tell me the story behind your initial interest in science/STEM?
   a. Can you give a specific example?
   b. Tell me more…

3. What impacted your decision to choose NIU?
   a. Why did you choose to transfer?

4. How did you decide on your major?
   a. Who, if anyone, had an impact on your decision?

5. Can you describe a high point in your undergraduate experience so far?

6. Can you describe a low point in your undergraduate experience so far?

7. School can be tough! Who/where do you turn to for support?
   a. Give an example. Can you tell me a story of when you did this?

8. Describe your interactions with your peers as an undergraduate.
   a. At NIU? (For transfers, before NIU?)

9. What is one difficult decision you’ve made as an undergraduate so far?

10. What is the most rewarding part of being a STEM major?

11. What is the most challenging part of being a STEM major?

12. Describe your interests outside of school.

13. Tell me about your goals for your degree in STEM.

14. Tell me about the proudest moment in your undergraduate education so far.
APPENDIX D

RESEARCHER REFLECTIVE QUESTIONS
Post-group reflection questions

1. Write down a brief overview of the sequence of events/activities/discussion topics from beginning to the end of the group. (Basically, what happened in group today?)

2. What are the most significant/memorable moments or interactions from group tonight? What specifically happened and why does this seem significant/memorable?

3. What is/are my primary feeling(s) immediately following group? What is/are the source(s) of these feelings? Can I trace them to any particular incidents/moments/people in the group?
   a. Is this something that can be used to develop future activities/work for the group?
   b. Is this something that needs to be addressed in some way in a future group meeting?

4. Did I notice any unspoken tensions in the group? (These could be either tensions between group members or internal tensions of particular members.) What might be going on here? How could this be addressed and/or used in future group meetings?

5. Which group members were especially vulnerable/emotional/raw in this group meeting? How did other group members respond to this? How did I respond to this? Did it seem like they felt heard/supported? Why or why not? If not, then how can this be addressed in the future?

6. Which group members are being marginalized or ignored by other group members? Which group members do I have a tendency to ignore? How can this be addressed?

7. Are there any group members I am concerned about for any reason at all? Why?
8. Which group members spoke/interacted the least in group tonight? Is this an ongoing pattern, or more of a unique event? Do these people need to be purposefully drawn back into the conversation in the next group?
APPENDIX E

“STRANGE TRAILS” ACTIVITY
“When you follow the strange trails, they will take you who knows where.”
–Lord Huron, Way Out There

So often we are fed the idea that our lives will (or at least should) follow some kind of linear path, a straight line to the so-called “right place”. In reality, rarely do we follow a direct trajectory from A to B our whole lives. Some of us feel like we’ve never aligned ourselves in such a way. We all land on strange trails at some point—paths that challenge our previous knowledge, paths that inevitably change us. Unfortunately, there are many individuals and societal constructs that look down on such trails, often suggesting they are indicative of failure, weakness, or a lack of direction. Perhaps they are, but perhaps these strange trails are pivotal to our journeys: the winding roads, the detours, the backwards steps… They all lead us somewhere… Wherever that is…

~

Some questions to consider:

- Looking back on your life, what are some of the strange trails you have gone down?
- How have your strange trails shaped you?
- What is your perspective on these trails today? Has your perspective always been this way, or do you look back differently now?
APPENDIX F

“WAY OUT THERE” LYRICS BY LORD HURON
Way out There

Lord Huron

I'm a long way from the land that I left
I've been running through life and cruising toward death
If you think that I'm scared you've got me wrong
If you don't know my name, you'll know it now

I belong bodily to the earth
I'm just wearing old bones from those that came first
There are many more flames when mine is gone
They will build me no shrines and sing me no songs

I'm a long way from the one that I loved
I've been tending old flames, lamenting what was
Drifting in a land time forgot
If you think that I've changed, you know me not

I belong bodily to the earth
I'm just wearing old bones from those that came first
I been unraveling since my birth
Gonna wander out there and see what I'm worth

Find me way out there
There's no road that will lead us back
When you follow the strange trails
They will take you who knows where
If I found a way to stay with you tonight
It would only make me late, for a date I can't escape

Find me way out there
There's no road that will lead us back
When you follow the strange trails
They will take you who knows where
If I found a way to stay with you tonight
It would only make me late, for a date I can't escape
APPENDIX G

SEMI-STRUCTURED FOCUS GROUP INTERVIEW GUIDE
The purpose of this focus group interview is to capture the experience of the BELONG in STEM Peer Group over the course of this past semester. In doing this, I will be asking you to recap stories and experiences that I as your group leader was present for. This may feel strange, but this is an important part of the data collection process in that this interview will be recorded and analyzed for research purposes. Everyone’s feedback is requested for this interview, although it will not be possible for each of you to provide an answer for every question. It is not the goal of this interview to reach a consensus or to bring about debate, but rather to give you an opportunity to share your individual thoughts and experiences within the group setting. This means that you may be adding onto or relating to others’ experiences, which in turn has the potential for consensus and/or debate (and this is fine). This interview will last approximately 2 hours, for which you will be compensated $30 for your participation. Know that you will also have the opportunity to provide feedback about the peer group and about me in an electronic survey from Dr. Reeves that will open tomorrow. Now, are there any questions before we begin?

1. What was a high point during the peer group this semester?
   a. What was it about this event that made it a high point for you?
   b. Did other people see this event differently? (Was this not a high point for others?)
   c. Other high points for other members?

2. What was a low point during the peer group this semester?
   a. What was it about this event that made it a low point for you?
   b. Did other people see this event differently? (Was this not a low point for others?)
   c. Other low points for other members?

3. What was a turning point in the group?
   a. Turning point: a distinct event, activity, conversation, etc. when you felt a shift in your individual experience in the group OR for the group dynamic as a whole
   b. What was it about this event that made it a turning point for you?
   c. Did other people see this event differently? (Was this not a turning point for others?)
   d. Other turning points for other members?

4. In what ways have you felt supported by the group?
   a. Can anyone provide a specific example or tell a story?
5. What were some ways that you would have liked to be supported in this group that you did not experience this semester?

6. What was one way in which you have felt challenged by this group?
   a. Can anyone provide a specific example or tell a story?

7. What is one way you see this group differently now than you did at the beginning of the semester?
   a. Can anyone provide a specific example or tell a story?

*The questions up to this point have been centered around the inner-workings of the group. Now, I want you to think outside the group...*

8. In what ways has this group affected you beyond the group itself?
   a. Can anyone provide a specific example or tell a story?

9. What is one way you see yourself differently now than you did at the beginning of the semester?
   a. Do you connect this change in how you see yourself with this group in any way?
   b. If yes, how so?
   c. If no, then to what do you attribute this change in view?

*We are moving on to the final question of the interview. Again, the purpose of this research is to capture the experience of the group. That being said...*

10. If you were to describe the group to someone who had never been here but wanted to understand it, what would be important for you to include that has not yet been sufficiently covered during this interview?
APPENDIX H

MASTER LIST OF CODES WITH EXPLANATION OF REFINEMENTS TO CODING

RUBRIC
<table>
<thead>
<tr>
<th>Data Source</th>
<th>Theme</th>
<th>Subtheme</th>
<th>Definition</th>
<th>Example</th>
<th>Modifications / Clarifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTAKE INTERVIEWS</td>
<td>Challenges</td>
<td>Academic</td>
<td>External resources or experiences related to one’s education (e.g. high workload, difficult course content) that participants describe as emotionally/psychologically unhelpful and/or as having had a negative impact on their academic and/or personal development</td>
<td>“So the accountability and just the huge workload that comes with it has definitely been the hardest part for me.” – Shelby</td>
<td>Must occur within structure of academic context.</td>
</tr>
<tr>
<td></td>
<td>Internal/Self</td>
<td>Intrapersonal events, thoughts, actions, or inner voices that participants describe as having had a negative impact on their academic and/or personal development (e.g. internal feelings of inadequacy, time management)</td>
<td>“And time, it's going to be a lot of working and studying for exams... at the end is going to be stressful. And so I'm scared a little bit, a little worry, and a little anxiety.” – Harold</td>
<td>Related to self-regulation that is harmful or unproductive</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Relationships</td>
<td>Verbal or nonverbal communication, input, or connections with others (e.g. family, friends, peers, instructors) that participants describe as emotionally/psychologically unhelpful and/or as having had a negative impact on their academic and/or personal development (e.g. being discouraged by a professor versus no learning gains during a professor’s office hours)</td>
<td>“But they didn't think I would be able to handle the advanced classes. So that was pretty crazy... Oh, my math teacher. She acted like she wanted me to go in there, but she didn't care.” – Sonia</td>
<td>Could be individual or non-specific groups of people that are creating a barrier. If the barrier is a poorly taught class, this would be challenge-academic.</td>
<td></td>
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<tr>
<td>Category</td>
<td>Description</td>
<td>Example</td>
<td>Notes</td>
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<tr>
<td>Specific Events</td>
<td>Individual events that participants describe as emotionally/psychologically unhelpful, stressful, frightening, or traumatic and/or as having had a negative impact on their academic and/or personal development (e.g. being assaulted)</td>
<td>“My grandma was in the hospital... And then three of my dad's side of my family were in the hospital... And then I had to go to a memorial for my friend who had committed suicide that semester. So I was emotionally a mess...”  -Beth</td>
<td>Added to account for challenging events that did not fit into the other 3 bins</td>
<td></td>
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</tr>
<tr>
<td>Decision Points</td>
<td>Academic or personal decisions that participants describe as noteworthy, important, or difficult (choosing community college over a 4-year college)</td>
<td>“Well, choosing my major since I was undecided up until the end of my first year. That was a little bit stressful because I was trying to be mindful of the classes I was taking.”  -Gia</td>
<td>Representative of Baxter Magolda’s concept of “crossroads” in addition to other noteworthy decisions that go beyond self-regulation (in terms of external forces). Also representative of turning points/decisions that are indicative of a change in direction.</td>
<td></td>
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</tr>
<tr>
<td>Interest in STEM</td>
<td>Experiences or stories that participants describe as contributing to their interests in STEM and/or goals for the future (e.g. “love of learning”, hoping to go to graduate school)</td>
<td>“I enjoyed experimenting with stuff and I enjoyed the science because I didn't enjoy writing, I didn't enjoy math or reading.”  -Dan</td>
<td>Changed “Motivation/Interest” to “Interest” in STEM. Motivation is too closely linked with internal support/self-regulation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supports</td>
<td>Academic</td>
<td>External resources or experiences related to one’s education (e.g. conducting research, attending a professor’s office hours, receiving scholarship money) that participants describe as emotionally/psychologically helpful and/or as having had a positive impact on their academic and/or personal development; may include individual people who participants describe as having provided guidance, information, or other academic resources without otherwise mention of a distinct relationship (e.g. visiting a tutor or attending office hours)</td>
<td>“Probably my speech class was a high point. Just because I really hate public speaking. And it's just kind of-- it really made me feel more comfortable in doing that.” – Fiona</td>
<td>Note difference between support-relationship; Can include general mention of groups within an academic context – ex. “The teachers” versus a specific teacher)</td>
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<tr>
<td>Internal/Self</td>
<td>Intrapersonal events, thoughts, actions, or inner voices that participants describe as having had a positive impact on their academic and/or personal development (e.g. choosing to work individually on coursework, exceeding one’s own expectations of self, reassurance from self)</td>
<td>“It was just hard to be there, so to the fact that I pulled myself out of that, and I'm going to a university. And then I'm doing the damn thing... I'm proud.” – Helen</td>
<td>Merged with previous category called “internal voices”. Different from Other – Interest in STEM because of self-regulation and motivation included in this code.</td>
<td></td>
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</tr>
<tr>
<td>RESEARCHER REFLECTIONS</td>
<td>Challenges</td>
<td>Internal/Self</td>
<td>Social</td>
<td></td>
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<tr>
<td>------------------------</td>
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</tbody>
</table>
| Relationships | Verbal or nonverbal communication, input, or connections with others (e.g. family, friends, peers, instructors) that participants describe as emotionally/psychologically helpful and/or as having had a positive impact on their academic and/or personal development (e.g. being encouraged by a professor versus attending a professor’s office hours) | “...And so my teacher saw that interest and she advised me to take the career path... She said it's a long road but she definitely saw that I had great interest in it that she did not see in her other peer students...” – Andre | Note difference between individuals or groups mentioned in “support-academic” (here, having a connection must be indicated to be considered “support-relationship”)

| Internal/Self | Appearance of inner distress among individuals such as prolonged frowning or looking concerned; also group members missing from group or arriving late | “Gia and Fiona looked nervous again today.” – Reflection 5 | Merged previous quotes perception of discomfort. observed lack of enthusiasm, concerns |

<p>| Social | Observed social barriers such as difficulty sharing, awkwardness or silence during group meetings | “Gia, Christina, and Beth all noted that speaking in front of new people is a challenge for them.” – Reflection 1 | Merged previous codes: empty space, reluctance to sharing, difficulty sharing |
| Other | General group dynamic | Overall observations about the group’s atmosphere and/or progress as a unit that are not clearly supports or challenges | “I feel really happy that we had whole group conversation basically the whole time! I am happy that we worked through the awkward silences.” – Reflection 3 | Merged previous codes: team building, humor, perception of group dynamic improving, group dynamic progress, interests outside of STEM, learning other's backstories, new perspectives, feedback from students, giving students a voice, perception of group dynamic shifting, sharing/nodding, group dynamic observations, sharing life outside of STEM, feedback from group member, group input, progress with group overall, sharing accomplishment s, overall observations, perspectives/sharing personal stories with the group, sharing interests outside of STEM, sharing personal stories with the group, sharing strange trails, discussing current event on campus |
| Supports | Internal/Self | Appearance of individual members’ inner growth or support such as acting more comfortable in group (e.g. quieter members participating more regularly and with greater ease) | &quot;I feel like it was significant having our quieter members getting in the spotlight for a change Gia, Fiona, and Sonia. They all did a great job and the group responded really well to them. I feel like it solidifies the notion that everyone has something to contribute, hopefully to everyone but definitely to me as well. It’s not that I doubt them, I just worry about making them feel uncomfortable.&quot; — Reflection 8 | Merged previous codes: progress with quieter students, progress with quieter members |</p>
<table>
<thead>
<tr>
<th>FOCUS GROUP</th>
<th>Challenges</th>
<th>Reflections</th>
<th>Merged previous codes:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Relationships</strong></td>
<td>Observed social support such as members comforting one another or relating to each other’s stories</td>
<td>“It was particularly powerful when Helen shared and the group supported her. It was dark, but extremely moving to watch her open up and feel supported by her peers.” – Reflection 9</td>
<td>shared experiences, supportive environment, peer support, shared experiences/identities, friendliness and friendship, students relating, students supporting</td>
</tr>
<tr>
<td><strong>Group Content/Structure</strong></td>
<td>Unhelpful or unpleasant materials or activities done in group (e.g. not connecting to activity such as reading poetry)</td>
<td>“I felt like when we did more poems and more relating it was very much some listening and some not... And it felt, like you said, a little forced.” – Beth</td>
<td></td>
</tr>
<tr>
<td><strong>Internal/Self</strong></td>
<td>Reflections on one’s own identity or intrapersonal experiences (e.g. negative opinions of one’s own work habits) that participants describe as emotionally/psychologically unhelpful and/or as having had a negative impact on their academic and/or personal development</td>
<td>“A challenge would be like, ‘You need to chill a bit. Let others speak.’ So, that alone was a challenge for me because I like to always elaborate on things and share more things about myself.” – Andre</td>
<td></td>
</tr>
<tr>
<td><strong>Social</strong></td>
<td>Interpersonal feelings or experiences (e.g. awkwardness or difficulty speaking in front of others) that participants describe as emotionally/psychologic</td>
<td>“I would say, probably, initially, it was kind of awkward. So I would say it's a pretty low point. No one</td>
<td></td>
</tr>
</tbody>
</table>

Including items that would fit into a “challenge – social” category. Created to
<table>
<thead>
<tr>
<th>Supports</th>
<th>Time Management</th>
<th>Internal/Self</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group Content/Structure</strong></td>
<td>Planning and maintaining obligations with regards to time (e.g. fitting group meetings into schedules) that participants describe as emotionally/psychologically unhelpful and/or as having had a negative impact on their academic and/or personal development</td>
<td>Reflections on one’s own identity or experiences (e.g. finding acceptance in past actions) that participants describe as emotionally/psychologically helpful and/or as</td>
</tr>
<tr>
<td>Helpful or pleasant materials, activities, or structures of the peer group</td>
<td>“Well, when we got that sheet... I was just reading it, and I was like, ‘Oh my God. How am I going to fit this in with my schedule?’ because it just seemed like a lot on paper.” - Nicholas</td>
<td>“I feel like I've become more self-reflective because I feel like sometimes we'll come here and we'll talk about things, and I'll be</td>
</tr>
<tr>
<td><strong>Time Management</strong></td>
<td>“I really liked the days where it felt like the whole group was involved, like on the day where we did the show and tell and talent show thing. It's like we all had something to say or show, and it just felt like everyone was involved.” – Gia</td>
<td>Changed from “Perception of self” to “Support – Internal/Self” for consistency with previous codes.</td>
</tr>
<tr>
<td>Relationships</td>
<td>Connections, relatedness, or shared identities among individuals or within the group as a whole (e.g. forming friendships or not feeling like the only one struggling) that participants describe as emotionally/psychologically helpful and/or as having had a positive impact on their academic and/or personal development</td>
<td>“I think I'm really enjoying being in an environment with a lot of intelligent people. It's almost kind of motivating. You guys are doing so well, and I'm like- even if we're all struggling in some way in what we're trying to accomplish, it's really cool to see everyone trying their hardest in what they want to do.” – Christina</td>
</tr>
</tbody>
</table>

| having had a positive impact on their academic and/or personal development | like, ‘I've never even thought about that before. That's never even occurred to me to think about different things about myself.’” – Sonia |
APPENDIX I

ADDITIONAL CODES AND DISCUSSION
Table 8. Additional Codes Outside of the “Supports and Challenges” Framework

<table>
<thead>
<tr>
<th>Theme</th>
<th>Subtheme</th>
<th>Definition</th>
<th>Example</th>
<th>Total Counts</th>
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<tbody>
<tr>
<td>Other</td>
<td>Interest in STEM</td>
<td>Experiences or stories that participants describe as contributing to their interests in STEM and/or goals for the future (e.g. “love of learning”, hoping to go to graduate school)</td>
<td>“I enjoyed experimenting with stuff and I enjoyed the science because I didn't enjoy writing, I didn't enjoy math or reading.” – Dan</td>
<td>76</td>
</tr>
<tr>
<td></td>
<td>Decision Points</td>
<td>Academic or personal decisions that participants describe as noteworthy, important, or difficult (choosing community college over a 4-year college)</td>
<td>“Well, choosing my major since I was undecided up until the end of my first year. That was a little bit stressful because I was trying to be mindful of the classes I was taking.” – Gia</td>
<td>28</td>
</tr>
</tbody>
</table>

**Interest in STEM**

“Interest in STEM” will be discussed in this section for its relevancy as a driving force in students’ academic journeys, although it was not within the scope of the research questions for this study. Goals for the future were also included in this code, and clearly played a role in students’ attitudes, actions, and identities:

“I find the strength just because I know that I'm doing it for a good cause... it's going to lead me to a career path that I know I can help people, and I really love to help people. And I may not make everybody laugh, but I really want it to make my goal. It's that thing that I appreciate because, at the end of the day, I may have a really bad day, but I really like seeing how other people have a good day. And that makes me happy.” – Andre

“I feel like I'll really be making a difference and also that-- I hate to put it like this, but it's also very practical. So either way, I know I'm going to find somewhere where I belong in the STEM community. That was not supposed to be a pun...” [laughter] - Gia

Students talked about their interests in STEM being sparked and reinforced at various levels of their education:

“Well, growing up, I had one of those science kits where you would grow your own mineralized rock thing or whatever, and that was always a big interest of mine is science
and all that. And when I actually took science courses in high school and college as well, it became more interesting to me...” -Harold

“I think for me, it's when I was in my biology classes when I was in high school and stuff... I used to question... but why is it doing it? They'll give you the general overview, but I want to know the details. I want to know the nitty-gritty, the really scary stuff.” – Beth

“And so being an AP student, I was offered chemistry and psychology for my senior year... And at first it was fun, you blow stuff up... then [I] got into orgo chemistry and that's where my interest really flew out the roof because-- in a good way-- my mind was like, ‘Yes.’” [laughter] -Andre

"Nothing excites me as much as just sitting in the classroom and learning something new and understanding it... That's what I love... I love to learn so much.” -Shelby

Often times, students simply expressed genuine curiosity for science and an understanding of the world around them. Such components of the interviews were fascinating all on their own, as the students had a plethora to say about their intricate and diverse STEM interests:

“I just think [STEM major] is so cool because it's literally like it's everything. It's everything you do, it's everything you eat, it's everything-- and to me, it's very interesting that you can look at it like macro, like everything and then you can go micro. The possibilities are endless.” -Helen

“There's a lot to be said about how the different chemicals in your body react with one another. And that was really interesting to me. And I guess that's why I've always just had more of an affinity for [biology].” -Sonia

“Since I had no idea what that is I was like, ‘Let's try that out, it's the senior year.’ So I tried it and then when the teacher started talking about programming and started teaching all that I was amazed. How did I not know about this? Programming is everywhere... Every field, every job, it's everywhere. So that kind of took my interest...” -Pascal

“I'm passionate about animals. I love them. And somebody needs to take care of them in the world we're living in now with the deforestation and animals dying out and becoming extinct. Somebody needs to try their best to stop that.” -Harold

Some students mentioned individual people or experiences that fostered their interest in STEM or served as inspirational:

"[My physics teacher] was very big on getting women involved in science. It was her biggest [laughter] passion, I guess. So she was making sure that all the girls in her class
were-- ‘Hey, what do you all want to do?’ And when she found out I liked science, she was like, ‘Well, you have a really strong aptitude for physics. You should consider it.’ And I ended up really liking it and I remember kind of enjoying it from middle school. And I was like, ‘This is actually something I really like.’ I felt like physics gave a purpose to math, was kind of my thing.” -Christina

“So [my uncle]’s a [scientist]. He works in the Gulf of Mexico... And every time I'd see him I'd always ask him questions about that and what it's like, and stuff of that nature... And so after kind of growing on that, I decided on [my major]... I like the fact that he was outside kind of traveling, not stuck in cubicle because I don't want to do that. So definitely that aspect of it. The money was good, too. He's pretty well-off. He's done good for himself so that it has definitely lure as well.” -Nicholas

“And then I talked to my calc professor... because he was a high school teacher for a long time... And he was like, 'I've got to say, when I leave the classroom, you're sitting out there teaching all of your classmates for our homework....' And as soon as he said that, it just planted the seed in my brain... it never occurred to me because at [my previous university], when I was taking calc there, it was just so stressful constantly and I wanted nothing to do with it. And then, when I was at [community college] taking it, it was--I just, I loved it so much. And I found out I was good at it and all this stuff that I wouldn't have realized if [my professor] hadn't said that to me.” -Shelby

“My mom is [in] a [medical career] and she really enjoys what she's doing. She seems like she loves going to work and helping other people while I look at my dad who-- he's a [laborer] in the trades, union worker kind of-- he hates what he's doing because he wished he would have applied himself more. And I don't know... I just see my mom... how much she enjoys [her job]. And I just think that that would be the best for me, too... I always looked up to my mom, she [is] probably my biggest role model.” -Dan

**Decision Points**

Here I will briefly present results on “decision points”. Some, but not all of these experiences were presented as distinctly negative. All of the students described at least one significant decision that they had to make in their academic journey, and often these decisions were expressed as psychologically challenging. For example, in the following quote, Helen describes intense feelings regarding transferring universities:

“It was almost impossible. I didn't want to disappoint my family and myself. And I just, and I felt like if I stopped going, I would never go back. And that's what so many people were like, "If you don't go, you'll never go back." That's what people always say. And it was just so hard to make the decision. But I knew that I had to do that rather than failing all my-- because I could not bring myself to go. So, I either had to drop out, figure
something out so that I didn't get a bunch of Fs. And so then, I had to make like a snap--
make a decision. That was hard because for days and or a week, whatever, I was like,
‘Maybe I'll try again.’ But then I realized for financial reasons and for my grades, I have
to make a decision. And it was--made me sick, but overall, I think it was the best
decision.” -Helen

Other difficult decisions emerged such as selecting a major or choosing to go to community
college over a four-year school:

“Well, choosing my major since I was undecided up until the end of my first year. That
was a little bit stressful because I was trying to be mindful of the classes I was taking.
And not to I guess waste money. So that was one of the major decisions that I had to
make. One of the tougher decisions. Trying to figure out myself and what I think I would
be good at and what I would like.” -Gia

“Okay, out of college, one of the hardest ones was choosing between [art] and [biology]
for me, because those are kind of the two things that kind of defined me at that point. I
chose [biology] basically because it gave me a lot more stability.” -Beth

“Well, I mean, picking my major, that was a tough decision, for sure, just because that
decides the rest of your life, no big deal. And another one, I guess, was moving up here,
because last year I drove, and it was an hour each way, so that was tough. But at the same
time, moving up here is expensive and it's more money, so... I thought long and hard
about that, whether it would be worth it and what the benefits versus risks and all that
would be. So that was definitely a decision that I took a lot of time thinking about. It was
a tough decision.” -Nicholas

“And so, choosing, deciding to switch finally from [biology] to [physics] and being like,
‘Okay, this is what it's going to be.’ That was a very heavy decision, I guess. Not
negative in any way, but just a very, a hard, difficult decision to make.” -Shelby

“I was very involved in different things throughout high school, so yeah, that was also
part of why I ended up going to community college in [my hometown] too. Yeah. I think
just because... I really do enjoy being there. And people always say like, ‘Oh, you should
get out of [there] as soon as you can,’ sort of thing, but I don't know. I kind of I like it. I
don't know if I'll end up back there again, but I do enjoy my time back there.” -Christina

In the above quote, Christina is depicting a crossroads scenario whereby her personal knowledge
and emotions were being challenged by external input (Baxter Magolda, 2004). She elaborated
later in our interview that receiving a sizable scholarship also impacted her decision to choose
community college:
“I wasn't initially planning to go to community college, but I ended up getting a scholarship through the school district.” -Christina